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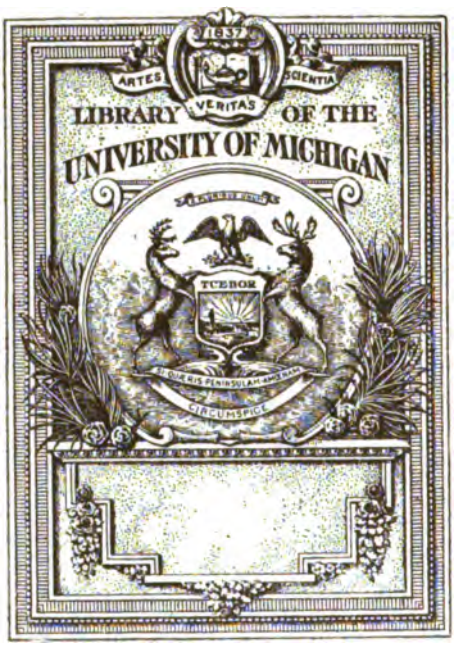
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THE CHEMIST;

A

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OF

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AND OF

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AND

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THE CHEMIST.

[NEW SERIES.]

I. CHEMISTRY.

MEMOIR ON COFFEE.*

BY M. PAYEN.

PAYSSÉ, Chenevix, Cadet de Vaux and Cadet de Gassicourt, examined the composition of coffee, without isolating any of its proximate principles; Runge discovered, and Robiquet studied, caffeïne, a crystallisable nitrogenous substance: Robiquet observed in coffee two fatty substances, one of which appeared to him analogous to the resins.

A skilful German chemist, Rochleder, examined, in 1844, the fatty matters of coffee: he extracted from it palmitic and oleïc acids; he showed that coffee does not contain resin; and he noticed the presence of a nitrogenous substance—legumine. The resisting tissue appeared to him to be formed of one of the ligneous substances which I have made known.

Notwithstanding the efforts of the scientific men I have named, the chemical knowledge attached to this important product left much to be desired. I have endeavored to extend it.

ORGANOGRAPHIC EXAMINATION.

The resisting mass, of a horny appearance, forming the perisperm or endosperm of these berries freed from their pericarp, presents under the microscope a tissue of juxtaposed cellules, with thick sides indented with irregular cavities, communicating with one another by small openings.

The thick sides, disaggregated by sulphuric acid in presence of iodine, acquired the blue color which denotes cellulose, then formed a gummy solution indicating dextrine. The agglomerated organic corpuscules, colored orange by these re-agents, showed, with their nitrogenous composition:—1. A peripheric cuticle covering, in all their folds, the surfaces of the perisperm. 2. The spongy nitrogenous substances filling the epidermic cellules, and containing oleïform matters. 3. In the more internal cellules, analogous granular bodies, containing fatty substances. 4. Lamelliform membranes, injected with nitrogenous matters, in the intercellular meati.

PROXIMATE ANALYSIS.

The coffee should first be reduced to a powder by means of a mill or a pestle and mortar; it is afterwards exhausted with ether in a displacement and continuous distillation apparatus.

The ethereal solution gives, on approaching to dryness, a fatty matter, which may be separated by washing with boiling water.

The aqueous solutions, mixed, leavea brown or fawn colored residue, which, treated with anhydrous alcohol,* yields, after evaporation, a crystalline deposit, which, washed twice in cold alcohol, dissolved twice in boiling alcohol and crystallised, gives caffeïne in distinct, white, brilliant prisms.

Pure caffeïne thus obtained for the first time directly, is fusible by heat and volatile without residue; its vapors, condensed, reproduced crystals sublimed in colorless and diaphonous prisms. It gave, in four analyses, numbers differing but little from the admitted composition. Its elementary composition and its equivalent weight, hitherto undetermined, would correspond to the following formula:—

* *Annales de Chimie et de Physique*, xxvi., 108.

* The portion of the aqueous extract which does not dissolve in anhydrous alcohol contains a small quantity of a new crystallisable compound of legumine and another nitrogenous matter.

391135

C^{16}	96	or 50·855
H^{10}	10	,, 5·085
N^4	56	,, 30·000
O^3	24	,, 14·060
	186	100·000

Coffee exhausted by ether was very carefully washed with alcohol of 0·60; the solutions, added together, were of a rather syrupy consistence: three times their bulk of alcohol was added to them. The liquid separated into two parts: one was viscid, and deposited; the other was very fluid. The latter, which contained the greater part of the new crystallisable compound, was decanted. It may be detected by putting a small quantity of the solution in a tube, and adding a drop of ammonia: the yellow color, verging on green, and that becoming gradually more intense, is a certain indication of this fact; it led to the process about to be described, and also served as a guide in the ulterior operations, when, having mother liquors to treat, it was necessary to eliminate by means of alcohol foreign substances from the compound just obtained. To take from the different precipitates a portion of the crystallisable compound, it is sufficient to dissolve them in a small quantity of water, then to precipitate it again by means of alcohol of 0·85 or 0·90; the supernatant liquor removes from the solution the substance sought.

All the alcoholic solutions were distilled on a sand bath. The syrupy residue was diluted with 0·25 of its bulk of alcohol at 0·90. Put into a cool place, it gave, after 24 or 48 hours, granular crystals, which were collected in a filter and purified with cold alcohol at 0·65; they were washed on a filter with alcohol of 0·70 to 0·85.

They were then re-dissolved to saturation in alcohol of 0·6, the mixture being heated in the sand bath. Cooling gives abundant and almost pure crystals: these are prisms grouped in spheroids by the re-union of one of their ends in a common centre. The purification is finished by re-dissolving in alcohol and re-crystallising twice. Finally, it is allowed to drain, and dried in vacuo at 230° F.*

* Throughout the processes which have for their object the extraction and purification of the new crystallisable compound, distilled water, free from air and traces of ammonia, must be used; the same water must be used for diluting the alcohol to the various degrees required; finally, it is necessary to keep the solutions in vacuo or ·der receivers, with shallow vessels of sul·ic acid.

PROPERTIES AND COMPOSITION OF THE CRYSTALLINE SUBSTANCES OF COFFEE.

The properties manifested by certain reactions on this substance could not be comprehended without first knowing its composition.

The colorless principle of the rich green coloration resides in the acid, which I call, for this reason, *chloroginic acid*. The crystallisable compound, or natural salt of coffee, is a double chloroginate of potassa and caffeïne. If it be rubbed when it has just been dried at 212° F. on a warm sheet of paper, it is electrified so as to adhere to the blade of a knife presented to it, and so as to maintain the form of long, bulky flocks.

When exposed to heat, it undergoes no alteration up to 300° F.; but towards 365° F., it fuses, developes a beautiful yellow color, boils, swells up to such an extent as to occupy five times its original space, and remains spongy, yellowish, solid, and friable. When heated to 450° F., it becomes brown; it is then partially decomposed. The vapors which are disengaged from it give, in condensing, crystals of caffeïne in needles. If it be heated further, the brown color becomes deeper, a fresh liquefaction takes place, abundant alkaline vapors are exhaled, the mass swells up again, so as to assume four times its bulk, or twenty times that of the crystals employed. The very light charcoal thus obtained has an iridescent surface.*

It is, doubtless, to the presence of the chloroginate interposed in the cellulose of the perisperm that the swelling of coffee berries in roasting must be attributed.

This double salt is very slightly soluble in anhydrous alcohol, even with the aid of heat.

Its saturated solution in alcohol of 95°, made with the aid of heat, allows it to crystallise, by cooling, in prisms radiating from common centres. Being more soluble in alcohol of 85°, its crystallisation from it on cooling is more abundant: the solubility increases with the dilution of the alcohol. Pure water dissolves still more of it, and this solution saturated with heat cools in the form of a mass. The cold solution, evaporated in a capsule, gradually separates a crown of very fine crystals in groups. The aqueous solution, even during crystallisation, is decomposed in the air, becoming first yellow, and then greenish brown.

Crystals of double chloroginate, gently

* The phenomena here pointed out were observed in operating on 1 decigramme of salt in a tube 5 millimetres in diameter and 0m. 12 in length.

heated in contact with potassa, become of a vermillion or orange red; heated further, the mixture fuses, takes a yellow color, disengages abundant ammoniacal vapors, becomes brown, &c.

Heated with monohydrated sulphuric acid, the natural salt of coffee developes an intense violet color and a bronzy pellicle. Hydrochloric acid produces analogous phenomena; under the influence of nitric acid an orange red color is manifested.

In solutions of the double chloroginate, acetate of lead gives a floculent, pale greenish yellow. The tribasic acetate produces a precipitate of similar form, but of a pure yellow color. Nitrate of silver, alone, does not produce any change, but, previously mixed with a very small quantity of ammonia, it gives a yellow color which inclines to brown; the liquor becomes turbid; a pellicle of reduced metallic silver very soon appears on the surface, and gradually extends to the sides of the vessel.

The proximate analysis of the double salt may be performed by several processes; the potassa is determined by incineration, and is represented by 0·11 of carbonate, or by the conversion of this salt into sulphate.

The compound dissolved and treated by a quantity of sulphuric acid equivalent to the potassa, then evaporated in contact with powdered marble, gives sulphate of potassa mixed with an acid chloroginate of caffeïne. Alcohol removes this organic compound whose acid may be precipitated by subacetate of lead. The caffeïne is extracted from the supernatant liquor, by washing the residue with cold alcohol, and treating what remains with hot alcohol; the latter, on cooling, deposits caffeïne in crystals.

The chloroginate of lead may also be obtained either by precipitating the alcoholic solution of the normal salt with tribasic acetate of lead and washing the precipitate, or by triturating the same salt, without heat, with an excess of protoxide of lead and water. In the latter case, the potassa left in the mixture renders the chloroginate of lead soluble, forming, doubtless, another double compound; but the disunion of the parts may be effected by a current of carbonic acid introduced into the filtered liquid. This solution retains the potassa and caffeïne.

The latter may be extracted by evaporating to dryness, washing the residue with cold alcohol, then dissolving the caffeïne in boiling alcohol, which, after filtration, makes its appearance, filling with its crossed needles the entire height of the liquid.

A fourth means, which is much longer, of extracting the caffeïne from the double salt, consists in producing an alteration of chloroginic acid under the combined influences of water, air, and ammonia. One gramme of the natural compound is dissolved in ten cubic centimetres of water; two or three drops of ammonia are added, and it is placed in a flat capsule under a bell glass in which the air is very slowly renewed. The yellow, green, and blueish green colors succeed in twenty-four hours; then the mixture acquires a brown tint. A little water is occasionally added to compensate for evaporation. After twenty or thirty days the conversion is finished; it is evaporated to dryness, and a very deep brown residue is obtained, which, detached in scales, powdered, and treated with boiling anhydrous alcohol, first dissolves and then crystallises the caffeïne by cooling. The alteration of the double salt by heat, carried only far enough to turn the swelled-up matter slightly brown, also enables us to extract a considerable portion of the caffeïne by means of boiling anhydrous alcohol.

EXTRACTION AND PROPERTIES OF CHLOROGINIC ACID.

Chloroginate of lead, completely purified by washing with boiled distilled water, and decomposed by a current of sulphuretted hydrogen, gives a solution which, rapidly evaporated, permits a confused crystallisation of chloroginic acid.

This acid, purified by small quantities of anhydrous alcohol, is white, soluble in anhydrous alcohol, more soluble in dilute alcohol, very soluble in water, and difficultly crystallisable. Its aqueous solution, almost saturated at the boiling temperature, crystallises only very slowly in microscopic prisms radiating from common centres, presenting, after 20 or 30 days, numerous agglomerations of spherules of one or two millimetres in diameter.

Chloroginic acid dissolved in water has a very acid re-action; it powerfully reddens litmus paper; it is the active principle in the different colorings noticed above in the natural salt of coffee. Heated in a tube, it fuses, turns yellow, boils, and leaves a thin shining layer of charcoal; its vapor condenses into a brown liquid, which, rapidly heated, leaves a very thin iridescent layer of charcoal.

The elementary analyses of chloroginic acid, of the double chloroginate of potassa and caffeïne, and of chloroginate of lead, gave the following results:—

Chloroginic Acid.

Carbon	56·0
Hydrogen	5·6
Oxygen	38·4
	100·0

Chloroginate of Potassa and Caffeïne.

Carbon	50·74
Hydrogen	5·38
Nitrogen	9·12
Potassa	7·50

Proximate Composition of the Double Chloroginate.

Chloroginic acid	63·5
Potassa	7·5
Caffeïne	29·0
	100·0

Proximate Composition of Chloroginate of Lead.

Chloroginic acid	40·0
Oxide of lead	60·0
	100·0

Equivalent Weight of Chloroginate Acid.

C^{14}	84
H^{8}	8
O^{7}	56
	148

Equivalent Weight of Chloroginate of Lead.

Acid	148
Oxide 2 Pb O	224
	372

Undoubtedly a greater number of analyses of the various compounds are required in order to establish definitively the composition and formulæ of chloroginic acid and of the chloroginates; but the following facts will remain demonstrated, independently of any further verification:—

1. A portion only of caffeïne is in the free state in coffee; it may be extracted directly, without heat, and very pure.

2. Caffeïne fulfils a basic part in the composition of the natural double salt.

3. The alterations of the organic acid, whether spontaneous or produced by an elevation of temperature, set caffeïne at liberty, and leave, combined with the potassa, a brown acid, the product of the ultimate transformation.

4. The double salt pre-exists in the normal state in the perisperm of coffee berries.

5. Among the curious properties of chloroginic acid, the remarkable power which it possesses of developing a very intense green color adds interest to the discovery of the crystallisable compounds which its rapid and variable transformations had hitherto caused to be overlooked.

AROMATIC ESSENCE OF COFFEE.

Among the properties which distinguish our aliments, one of the most important—the aroma which these substances exhale—performs a great part in the phenomena which precede and accompany the acts of nutrition: it guides our senses, and, however fugitive or diversified it may be, it still leaves an impression on the memory capable of influencing our selection in the presence of many kinds of food.

M. Chevreul, in a special report, has shown how we should take account of the aroma and taste of broth, and by what means they may be developed.

It is among the volatile acids, the etheriform or alcoholic compounds, the different substances carried away by the ammoniacal and aqueous vapors, and still more generally in the essential oils, that the more or less complex causes of odors reside, and, in particular, that of the aroma belonging to alimentary substances.

Coffee contains aromatic essences, which the fat oil obtained by the processes described above powerfully retains; the aromatic properties are modified by torrefaction, however slight.

It was in this state that it was desirable, with the view of applications, to extract, study, and weigh these odoriferous bodies. In the hope of attaining this object, and availing myself of the skilful co-operation of M. Poinsot, I made a great number of distillations of several commercial kinds of coffee, roasted at different degrees, in glass apparatus, fractioning the products; the latter were condensed at several temperatures, from 194° F. to from 4 to 6 below the freezing point of water.

The infusion obtained by means of warm water poured on ground coffee, in the proportion of one quart of water to 100 grammes of coffee, was put into the first flask of the apparatus; after two hours' boiling it did not retain any agreeable odor; the first receiver, whose temperature was gradually raised by the condensation of the vapor from 77° F. to 194° F., contained distilled water occupying 0·1 of the bulk of the infusion, On this water, which was of a slightly yellow color, floated a few drops of a concrete white essence; this essence, like the rest of the distilled liquid, was almost entirely deprived of the agreeable aroma, whose traces might be confounded with the odor developed by several animal matters altered by boiling.

The second receiver, maintained at the temperature of 77° to 86° F., had received scarcely 0·01 of the bulk of the infusion in the form of a liquid, which was distilled when the temperature of the first receiver had been allowed to rise to 194° F. This liquid, on which floated minute quantities of concrete essence, exhaled an agreeable aromatic odor, resembling that of coffee itself, but so

intense that a few drops of this water were sufficient to communicate to a cupful of milk or any inodorous liquid, the agreeable aroma of coffee.

The particles of concrete essence were not the source of this aroma; for, isolated and washed, they did not appear to retain any: thus, the aromatic matter was entirely soluble in water.

The third receiver, cooled several degrees below the freezing point, condensed a few drops of water exhaling the mixed odor of coffee and of the pyrogenous hydrocarbons; the latter odor existed especially in the fourth receiver, equally cooled, but whose sides had condensed only traces of moisture; the same empyreumatic odor predominated even in the aeriform matters which issued from the fourth receiver. The presence of carburetted hydrogen in the gases was proved by passing them into a tube with bulbs full of concentrated sulphuric acid: this acid acquired a deep brown color, and a deposition of carbonaceous matters took place when the acid was diluted with water.

The presence and proportions of the carbon in these gases may be determined by directing them through a tube for elementary analysis filled with binoxide of copper, and collecting the carbonic acid disengaged.

The proportions of the very volatile empyreumatic carburets with a disagreeable odor increased more and more when the roasting of the coffee had been carried from that which corresponds to a loss in weight of 0·18 to that which is equivalent to the loss of 0·25 beyond.

It is evident that it is possible to isolate the residue and the products of an infusion of coffee, so as to retain, in a form reduced to a bulk of $\frac{1}{100}$, the greater part of the aromatic principles. These latter are complex; two odoriferous essential oils may be extracted from them. It is sufficient, for that purpose, to strongly agitate the distilled water which contains them, with 0·20 of its bulk of ether; it is left to repose for a quarter of an hour, when the supernatant ethereal solution is removed with a pipette. This operation is repeated four times, and the evaporation of the ether leaves an orange-colored oil, the very powerful odor of which partly resembles the aroma which prevails more or less in all varieties of coffee. Ten grammes of the water distilled from Mocha coffee gave one centigramme of this oil, taking account of the waste during the evaporation of the ether, which waste may be determined by dissolving this essence a second time in ether, and weighing again after a second evaporation. This essential oil was formed of two parts; one, less volatile and less fluid, appeared to result from the alteration of the oil possessing the most agreeable aromatic odor. There remained in the water, agitated with ether, an etherial solution of the second essence, endowed with a very sweet aromatic odor; its proportions, small in the inferior qualities, but large in Mocha coffee, appear to constitute the principal differences between the commercial qualities. It may easily be extracted by placing pieces of chloride of calcium in the first two receivers; the solution of the chloride raises the temperature in these vessels as the vapor condenses in them. A third receiver, surmounted by a tube filled with chloride of calcium, cooled to 68° F., retains, with the saline solution, almost all the aromatic essence which is extracted by means of ether. The total weight of the essence thus obtained amounted at most to two ten-thousandths of the weight of the coffee, and this may be understood, since one drop of this oil diffused over a room a strong odor of coffee.

The variable qualities for a long time observed in the coffees of commerce are owing chiefly, doubtless, to the varieties cultivated, and to the habitual or accidental circumstances of vegetation, such as exposure, soil, locality, the care taken in cultivation, and the atmospheric conditions. It would be interesting to endeavor to determine the influences of these different causes on the qualities of the product.

I devoted attention to discovering the principal differences between two commercial varieties, concerning the origin of which I could not have the least doubt—Martinico and Mocha coffees.

The first is ordinarily in large berries, presenting a depressed face; some berries, rolled in ellipsoïds, proceeding from fruits of which one of the ovules was absent. Some berries, still more rare, have a slightly angular form, dependent on the presence and the mutual pressure of three ovules in the same fruit.

Mocha coffee differs from the foregoing in that its berries have a yellowish grey color; they are smaller, their forms more irregular, very generally flattened on the side, which is in contact with another berry in each of the fruits. Some berries only are rounded, because they are found, each separately developed, in a fruit in which one of the ovules is wanting.

Many characters distinguish Mocha coffee from all others; the fatty matter, which is rather more abundant, forms 13-hundredths of the total weight; I could separate only two parts having different points of fusion, difficult to determine. It retained more powerfully a portion of the aromatic essence, sweeter, and in greater quantity.

The fatty matter of Martinico coffee, extracted by the same means and exhausted by boiling water, is browner and less fluid; it may be separated into 4 parts, whose melting points are, respectively, 41, 65, 122, and 194° F. This last part resembles the wax of leaves.

The presence of a waxy matter and the green color of the berries might depend on the period of gathering and the time at which the barking was performed. In removing the pulp of the fruit when it is full of juice, the perisperm being quite moist, must undergo in the air certain re-actions to which oxygen gives rise: thus the chloroginate undergoes partially the green transformation, the fatty substances are altered, and the essence, less abundantly secreted, may thus be altered and partly escape.

These hypotheses, which agree with the results of analysis, led to the idea that the quality of certain coffees might be improved by allowing them to come to a more complete degree of maturity before the decortication. Perhaps if a portion of the crop was left to ripen and dry, a quality would be obtained analogous to those mixtures of Mocha coffee with green coffees—of which many people prefer the mixed aroma to the more soft aroma of the pure Mocha. This interesting subject, with observations made in our colonies, might be concluded, in France, with analytical experiments.

The influence of the period of gathering, and of a particular mode of decortication, seems to me to be manifested also in the results of the preparation of a very peculiar kind of coffee, called Yungas in Bolivia. This sort is in regular bulky berries of a yellowish grey color. Under these appearances, we see only a light envelope in which lies a perisperm of the same form and similarly marked; but which, having shrunk more considerably by desiccation, is much smaller than the berries of ordinary coffees. In order to obtain this kind of coffee, it is gathered and barked very long before maturity. It is a fancy coffee which the Bolivians prefer, doubtless from custom, although it developes less of the soft aroma which characterises Mocha and several varieties generally esteemed.

In combining the different analytical results, it was found that coffee in the normal state, presents as nearly as possible the following composition:—

Cellulose	34
Hygroscopic water	12
Fatty substances	10 to 13
Glucose, dextrine, vegetable acid undetermined	15·5
Carried forward..	74·5
Legumine, casein (glutine)?	10
Chloroginate of potassa and caffeine	3·5 to 5
Nitrogenous organism	3
Free caffeine	0·8
Concrete essential oil, insoluble in water	0·001
Aromatic essence, fluid, with a sweet odor, soluble in water, and, less soluble, aromatic essence	0·002
Mineral substances: potassa, lime, magnesia, phosphoric, sulphuric and silicic acids, and traces of chlorine	6·697
	100·000

It would be very interesting to know the special effects, in the animal economy of the well-characterised substances which enter into the composition of coffee, and are not found in any of the matters proposed as a substitute for it—what is the action of caffeine which is so little alterable, of the double chloroginate with a bitter after taste, so unstable in the presence of oxygen, and, finally, of the aromatic essences? We hope that our learned practitioners will enlighten us on this point.

But already they have taught us, and the experience of every day confirms it, that coffee, differing from the powerful alcoholic drinks and narcotic vapors which intoxicate and stupify the senses, seems to unite all that is agreeable in the sensations of both orders, exciting the intellectual faculties.

Supposing that the principal cause of the special effects of coffee does not reside in the agreeable, diffusible aroma, it cannot be doubted, at least, that this property has the greatest influence on the commercial value; for this value is fixed according to the greater or less power, and the sweetness of the aroma in each variety; now, if we were to admit for the ponderal quantity of the essence only two-thirds of the price of coffee, we should attribute to the principal essential oil the enormous value of 10,000 francs (£400) the kilogramme.

INVESTIGATIONS CONCERNING THE COMPOUND AMMONIAS.*

BY M. ADOLPHE WURTZ.

PREPARATION AND PROPERTIES OF METHYLAMINE.

The process by means of which I obtained this base does not differ from that which

* *Comptes Rendus*, No. 7, August 13, 1849.

chemists employ for preparing ammonia. Perfectly dried hydrochlorate of methylamine is mixed with twice its weight of quick lime, and the mixture is introduced into a long tube, closed at one end, so as to occupy half of it; the other half being filled with pieces of caustic potassa, a disengagement tube is adapted, which passes into a test glass filled with mercury. The tube is slightly heated, beginning with the closed end; the methylammoniac gas, displaced by the lime, is abundantly disengaged, and passes into the test glass filled with mercury.

Thus prepared, methylamine is a non-permanent gas. Towards 32° F. it condenses into a liquid of great mobility. Its odor is strongly ammoniacal. Its density was found to be 1·13; it is, therefore, rather more dense than the air. The number found by experiment is a few hundredths higher than the theoretical number, which is 1·075. This, doubtless, is owing to the gas being too near its point of liquefaction at the temperature of 87°, at which the experiment was made.

Methylammoniacal gas is the most soluble of all the gases at present known. At the temperature of 54° F. one volume of water dissolves 1,040 volumes; a higher temperature diminishes this solubility, as might be expected. At 87° F. water takes up only 959 times its bulk.

Like ammonia, it is instantly absorbed by charcoal.

Like ammonia, it instantaneously restores the color of reddened litmus, and gives very thick white fumes in contact with a stirring rod dipped in hydrochloric acid. Like ammonia, it absorbs its own volume of hydrochloric acid and half its volume of carbonic acid. It is distinguished from ammonia by the following property: in contact with a lighted candle it takes fire, and burns with a yellowish flame.

The composition of methylammoniacal gas is represented by the formula—

$$C^2\,H^5\,N = 4 \text{ vol.}$$

This formula is deduced from the following eudiometrical analyses:—

	I.	II.
Methylammoniacal gas	23·3	26·5
Oxygen	67·7	71·0
Residue of combustion	42·0	51·8
Carbonic acid	23·0	26·0
Nitrogen	12·5	14·5
Oxygen absorbed	54·4	59·7

An elegant and rapid method of analysis consists in heating this gas with potassium in a bent glass tube. Cyanuret of potassium is formed and hydrogen is disengaged:—

$$C^2\,H^5\,N + Po = C^2\,N\,Po + H^5.$$

The solution of methylamine possesses the strong odor of the gas itself. Its taste is caustic and burning.

Iodine, in re-acting on the solution of methylamine, is converted into a powder of a pomegranate red, and the liquor, which is scarcely colored, contains hydriodate of methylamine IH, $C^2\,H^5\,N$. The red insoluble compound which is thus formed is analogous to iodide of nitrogen.

The salts of magnesia, alumina, manganese, iron, bismuth, chromium, uranium, tin, lead and mercury are precipitated by methylamine as by ammonia.

The salts of zinc at first gives white precipitates, but they are re-dissolved in an excess of the re-agent.

The salts of copper are precipitated of a blueish white; an excess of the re-agent readily dissolves the precipitate, forming a liquor of a deep blue color.

The salts of cadmium, nickel, and cobalt, are precipitated by the solution of methylamine; an excess of the re-agent does not redissolve the precipitate.

Nitrate of silver is completely precipitated by methylamine; oxide of silver easily dissolves in an excess of re-agent. When this solution is left to spontaneous evaporation, a black body is precipitated from it, which is analogous to fulminating silver. This substance does not explode either by a blow or by heat. Chloride of silver dissolves in the solution of methylamine. Chloride of gold is precipitated of a brownish yellow; an excess of re-agent readily re-dissolves the precipitate, forming a liquid of an orange-red color. A concentrated solution of chloride of platinum gives, with methylamine, a deposit crystallised in orange-colored bractæ, formed by the double hydrochlorate of methylamine and platinum.

PREPARATION AND PROPERTIES OF ETHYLAMINE.

I obtained this base by decomposing the hydrochlorate of ethylamine by lime. The apparatus was arranged as for the preparation of methylamine. Only, as ethylamine condenses easily, and is liquid at the ordinary temperature, the disengagement tube was passed into a matrass surrounded with ice, or, better still, with a frigorific mixture.

The ethylamine liberated by a gentle heat distils, and condenses in the receiver.

In the state of purity, it is a light, very mobile, and perfectly limpid liquid. It boils at 64° F. When poured on the hand, it instantly volatilises, producing a sensation of intense cold. It gives out an extremely penetrating ammoniacal odor; its caustic-

city is like that of potassa. Ethylamine powerfully restores the color of reddened litmus. In contact with hydrochloric acid it gives very thick white vapors. Each drop of acid poured into it produces a hissing sound at the moment of its combination with the base. Baryta and caustic potassa may remain in it at the ordinary temperature without alteration.

On the approach of a body in combustion, ethylamine takes fire and burns with a blueish flame. It mixes with water in all proportions, disengaging heat, and giving a solution whose basic properties are exactly the same as those which I have pointed out in describing the character of methylamine. I have remarked, however, that the hydrated oxide of copper dissolves less easily in ethylamine than in methylamine.

Chloride of platinum is not precipitated by ethylamine.

When a solution of ethylamine is mixed with oxalic ether, the mixture very soon becomes turbid; alcohol is formed, and very fine crystals, of a compound which is to oxamide what ethylamine is to ammonia, are separated. It is ethyloxamide, whose composition is represented by the formula—

$$C^6\ H^6\ N^2\ O^2.$$

The composition of anhydrous ethylamine is represented by the formula—

$$C^4\ H^7\ N,$$

which was deduced from the following analyses:—

I. 0 gr. 266 of matter yielded 0·523 carbonic acid, and 0 gr. 374 water.

II. 0 gr. 284 of matter yielded 74 c.c. 7 nitrogen, at 58° F. and 746 m. 5 pressure.

III. 0 gr. 239 of matter yielded 64 c.c. 6 of nitrogen at 58° F., and at 0 m. 755 pressure.

These numbers give in hundredths:—

	Experiments.		Theory.
Carbon	54·4		54·3
Hydrogen	15·9		15·5
Nitrogen	30·9	31·3	31·2

ON THE QUALITATIVE AND QUANTITATIVE ANALYSIS OF PHOSPHORIC ACID.*

BY M. C. LECONTE.

The investigation of phosphoric acid, by means of the re-agents hitherto employed, presents great difficulties.

Having put almost all the known oxides in contact with phosphoric acid, the phosphate obtained with oxide of uranium presented a great superiority over all the others, in its almost absolute insolubility in water, and the rapidity with which it deposits, leaving a clear liquor.

Numerous experiments have proved the certainty with which the soluble salts of uranium detect the presence of phosphoric acid. The following two facts, proved a great number of times, will suffice to establish it:—

1. 0·05 gr. of syrupy phosphoric acid, added to one gallon of distilled water, furnished with nitrate of uranium, aided by boiling, a very abundant precipitate; salts of soda, potassa, ammonia, lime, and magnesia (in the latter two cases the liquor was acidulated to keep it limpid), added to the liquor to be tested, did not prevent the formation of the precipitate; the same salts, added to the distilled water, did not precipitate the nitrate of uranium.

2. Phosphate of lime was dissolved in hydrochloric acid; the very dilute solution gave a very abundant precipitate.

The estimation of phosphoric acid in the soluble phosphates is very simple. A solution of nitrate of uranium is made, of which one cubic centimetre will precipitate 0·001 grs. of phosphoric acid: a known weight of the phosphate to be analysed is dissolved in a known bulk of distilled water, taking care to neutralise it; 50 cubic centimetres of this liquor are boiled in a small flask, and, by means of a graduated burette, the nitrate of uranium is poured in until no further precipitation takes place, taking care to boil for a few seconds after each addition of the test solution.

In an early paper I shall give a process of estimating the phosphoric acid in the insoluble phosphates by means of nitrate of uranium.

* *Comptes Rendus*, No. 3, July 16, 1849.

ON THE CONSTITUTION OF STYRACINE.*

BY DR. A. STRECKER.

A certain analogy between the constitution of styracine and that of the natural fats has been demonstrated, and is the more worthy of attention as no acid corresponding to cinnamic acid has hitherto been discovered in nature in such conjugate union: nor, except the alcohols of the series $C^2n\ H^2\ (n+1)\ O^2$, which correspond to the acids $C^2n\ H^2n\ O^4$, was even the occurrence of glycerine in analogous combinations ever known. The conjugate compounds of gly-

* *Annalen der Chemie und Pharmacie.*

cerine with the fatty acids occurring in nature appear, however, according to Gerhardt, to differ from the conjugate alcoholic compounds, as well as from the compounds of glycerine artificially prepared, inasmuch as they are decomposed, absorbing 6 eqs. of water, into 2 eqs. acid, and 1 eq. glycerine ($C^6 H^8 O^6$); but this cannot be regarded as perfectly established, owing to the difficulty of obtaining these compounds pure, which is augmented by their general high atomic weights. They differ from the natural ethers, inasmuch as the latter furnish in decomposition only 1 eq. acid to 1 eq. alcohol, 2 eqs. of water being assimilated. The artificial compounds of glycerine which correspond to the acid ethers, furnish, like them, 2 eqs. acid, and 1 eq. glycerine, 2 eqs. water being assimilated.

Regarded in this light, styracine, although closely approximating to the fats, seems to be more intimately related to the conjugate alcoholic compounds, amongst which spermaceti, and, according to Brodie, one constituent of wax, should be included.

The formula of styrone propounded by Dr. Toël not having been controlled by a determination of its atomic weight, we may indicate for this body other formulæ, likewise in accordance with the composition found. I think I have succeeded in finding a formula for styrone, which has the power, in common with that of Dr. Toël, of accounting for the constitution of the compounds, but is preferable from its greater simplicity. My formula for styrone is $C^{18} H^{10} O^2$, which requires, in 100 parts:—

	Calculated.	Found.		Toël.
Carbon..	80·62	79·8	80·2	80·6
Hydrogen	7·45	7·6	7·7	7·6
Oxygen	11·93	12·6	12·2	11·8

The analyses agree, as to the amount of hydrogen, better with my formula than with that of Dr. Toël.

According to this the composition of styracine is:—

1 eq. Cinnamic Acid....	C^{18}	H^8	O^4
1 eq. Styrone	C^{18}	H^{10}	O^2
	C^{36}	H^{18}	O^6
— 2 eqs. Water.....		H^2	O^2
=1 eq. Styracine	C^{36}	H^{16}	O^4

and the composition in 100 parts:—

	Calculated.	Found.			Toël.
Carbon..	81·85	82·56	82·57	82·61	82·15
Hydrogen	6·02	6·12	6·49	6·36	6·16
Oxygen..	12·13	11·32	10·94	11·03	11·69

The quantity of carbon obtained is much greater than that calculated; but it is well known that this is not impossible in combustions in oxygen gas; on the other hand, the loss in hydrogen by the other formula is avoided by this.

The formula of chlorostyracine becomes $C^{36} H^{12} Cl^4 O^4$, and its per centage composition:—

	Calculated.	Found.	
C	58·79	53·64	
H	3·00		
Cl	35·27	35·40	35·60
O	7·94		

Styrone might, perhaps, be regarded as the hydrate of an oxide ($C^{18} H^9$), and its constitution would then be represented by $(C^{18} H^9) O + HO$.

Setting aside all theoretical views concerning the alcohols, styrone stands, according to the foregoing formula, in the same relation to cinnamic acid as vinous alcohol to acetic acids, ethal to cetic (ethalic) acid; or, to express it in a few words, *styrone is the alcohol of cinnamic acid*:—Styrone= $C^{18} H^{10} O^2 - H^2 + O^2 = C^{18} H^8 O^4$=cinnamic acid. Styrone contains 2 eqs. more hydrogen and 2 eqs. less oxygen than cinnamic acid, as in the case of all other known alcohols.

PROPORTION OF LIME IN LIME WATER.*

BY M. WITTSTEIN.

ACCORDING to this chemist, 732 parts of cold water dissolve one part of anhydrous lime. The experiments to determine the solubility of lime in boiling water gave no satisfactory result. Three experiments gave respectively 1495, 1570, and 1311 parts of boiling water to one part of anhydrous lime. The carbonate of lime which is separated from lime water by exposure to the air is the neutral carbonate, Ca O, CO^2.

COMPARATIVE STUDY OF THE AURIFEROUS SANDS OF CALIFORNIA, NEW GRANADA, AND OF THE OURAL.†

BY M. DUFRENOY.

THE French Consul at Monte Rey has forwarded to the Minister for Foreign Affairs a collection from the gold workings in California; a portion of this collection has been sent to the *Ecole des Mines*, and I have had an opportunity of examining it: it comprises:—

* Buchner's *Repertorium*.

† *Comptes Rendus*, No. 8, Aug. 20, 1849.

1st. Two samples of auriferous earth taken from the surface of the ground, in two parts of the Valley of Sacramento.

2nd. Auriferous sand, resulting from very thoroughly washing the same earth, and in which bractem of gold are distinctly visible.

3rd. Pieces of quartz and fragments of rocks collected in the alluvion which constitutes this valley.

4th. Two pieces of native gold.

5th. Lastly, bractem of gold from three different parts of the Sacramento, namely, from the American river at its entrance into the Valley of Sacramento; from the same river at 48 kilometres (about 30 miles) from its mouth; and from the River de las Plumas, from 60 to 72 kilometres (37 to 45 miles) distant from the first. These three points make known nearly one-fifth of the valley of Sacramento, which commences in the Sierra Nevada (Snow Mountains), and terminates in the ocean at the Port of San Francisco. Its course, which is nearly east and west, is from 336 to 360 kilometres long (210 to 225 miles).

The bractem of gold from California are much larger than those of the washings of the Oural and Brazil. They likewise differ from them in their reddish color, which enables us to distinguish them at first sight; their composition, according to the analysis made by M. Bivot,* is—

Gold	90·70
Silver.....	8·80
Iron	0·38

The earths of the Valley of Sacramento are light; to the touch they are very soft, but rubbing on the hand discovers some rough particles: their color is a light brown; the microscope shows them to be almost entirely silicious; the small fragments of which they are composed are angular and transparent; they very readily collect in lumps, and resemble, in color and transparency, a saline mass: by the naked eye only very few distinct grains are visible.

The piece of gold sent to the *Ecole des Mines*, weighs 47.9414gr. (about 740gr.); its color is reddish; its composition is very analogous to that of the gold in bractem. This piece adheres to milky white quartz, whose surface resembled that of pebbles, washed in a river; however, it retains its general form, which is that of a thick, flat, and irregular vein.

The form of this piece and the presence of quartz show us that, in its primitive situation, the gold forms veinules with a quartzy gangue.

Annales des Mines, tome xiv., p. 105; 1848.

The schistous fragments which exist in the alluvion of the Valley of Sacramento, lead us to imagine that the mountains which contain the auriferous veins are rather micaceous schist than granite properly so called: this conclusion likewise flows from the examination of the washed auriferous sands.

NATURE OF THE AURIFEROUS SANDS OF CALIFORNIA.

The general color of these sands is black. It is perceived at the first glance that oxide of iron predominates in them, and that it is to that mineral that their color is owing. I therefore commenced by separating the oxide of iron by means of the magnet: 3 grammes gave 1·79gr. of oxide of iron, or 59·82 per cent. Notwithstanding the separation of this large proportion of oxide of iron, the sands retained their black color: they were very rich in gold, and a greater number of bractem were observed in them.

Examined with the microscope, the sands remaining after the separation of the oxide of iron contained some octohedral crystals, some with reflecting and but little altered faces—others rounded, but still brilliant. These crystals, from their form, and the color of their dust, appeared to be the titaniferous oxide of iron. They were mixed with flattened crystals, which, from their hexahedral projection and red dust, may be regarded as specular iron ore. Finally, among the black grains were observed very tender, dull, irregular fragments, which had all the characters of manganese.

The titaniferous oxide of iron predominated greatly in this second portion of the sands, the manganese, on the contrary, being much more rare: this second kind of oxide of iron was clearly distinguished from that separated by means of the magnet: the latter, fragmentary and tarnished, is rounded in some parts.

Mixed with the titaniferous oxide of iron, in the second portion of the sands of California, were found many white crystals of zircon, terminated at their two extremities, whose forms are very clear. These are—1. Four-sided prisms, surmounted by an octohedron with a four-sided base, placed on the angles. 2. This same prism, presenting, besides the octohedral points, facettes, *i*, resulting from the intersection of the common angle in this octohedron and the prism. 3. Prisms with eight faces formed by the two four-sided prisms M and *h'*. These crystals are generally very short. Their perfect transparency, with their total absence of color, caused them to be taken, at first sight, for quartz; but, on counting the

number of their faces, which it is very easy to do with some of them, it cannot be doubted that they belong to a prism with a four-sided base.

Notwithstanding their small dimensions, the clearness of these crystals is so perfect, that the incidence of several of the faces may be measured. M. Descloizeaux found that the angle of *i* on *i* is 147° 30′, which differs only a few minutes from the value of the corresponding angle in the zircon. I was also able to observe the angle of the faces *i* on *i* and M on *i* in crystals of zircon from New Granada, of which I shall speak further on. I obtained for their values 133° and 149°, which approximate to the values 133° and 148° 7′ given by Philips for the same angles.

A remark which appeared to me interesting, at least in the point of view of the power of crystallisation, is that the crystals of zircon are often penetrated with other crystals which are entirely enclosed in it, as observed with the needles of titanium in rock crystal. These crystals, often of a milky white, or even colorless, are perfectly distinguished under the microscope by the different manner in which light falls on them; some are of a hyacinth red.

The white zircon, so abundant in the sands of California, is generally rough. I remember that it exists in some abundance in the Zillerthal, in the Tyrol.

The sands of California contain also colorless hyaline quartz and smoky hyaline quartz. This quartz, always fragmentary, is distinguished by its vitreous and concholdal fracture; there are, indeed, remarked in it fragments of a light blue, which can only be corindon.

The grains of washed sand are generally 0m. 00005 in length, and 0·00001 in diameter; these dimensions admit of their being isolated, or, at least, easily grouped under the microscope. I profited by this circumstance to establish approximatively the proportion of the elements which I have just noticed; it was sufficient for me to calculate them. In the first operation I operated on only 560 gr., in the second, on 352; the mean of these two operations gave the following results:—

Oxide of Iron obtained by the magnet	59·82
Titaniferous oxide of iron, specular iron, with a trace of oxide of manganese	16·32
Zircon	9·10
Hyaline quartz	13·70
Corindon	0·67
Gold*	0·29
	100·00

* The gold was determined by the dry assay.

The difference which exists in the size and form of the grains, and that presented by the specific gravity of each of the elements of which the auriferous sands of California are composed, should cause these proportions to be considered as giving only a rough approximation to their composition. However, they correspond very well with the idea of its composition formed on looking at it, and are interesting from the indications which they furnish of the nature of the auriferous soil. It will be remarked, besides, that the specific gravity of the sands of California is about 4·37, and that the oxide of iron weighs 5·09. These numbers agree very well with the composition above indicated.

The crystalline state of the titaniferous oxide of iron and of the zircons show that the ancient soils whose destruction has produced the auriferous alluvion of the Valley of the Sacramento are not distant, and everything leads me to consider it as belonging to the chain of the Sierra Nevada. The perfect preservation of these crystals, and especially the particular circumstance of being terminated at their two extremities, makes me conjecture that these rocks are schistous. In the granites, indeed, the crystals adhere to the rock, and present only one summit; in schistous rocks, on the contrary, the crystals, very frequently lying in the direction of the stratification, are complete. Such are the staurotides and the disthenes of Saint Gothard, disseminated in the talcky schist, the macles of Coray in Brittany, and especially the small crystals of tourmaline so frequently met with in the micaceous schists of Morbihan. There is, therefore, reason to believe that the Sierra Nevada, or Snowy Mountains, which form the western limit of California, are, in great part, micaceous schist and talcky schist.

The interest I felt in the examination of the auriferous sands of California made me desire to compare them with the auriferous sands of several localities, and I have made a comparative study of the auriferous sands of New Granada, sent to me by M. Amedée Burat, and of the sands of the Oural, detailed by M. Le Play.

SANDS OF NEW GRANADA.

The sands of New Granada were collected in the Valley of Rio Dulce, situated in the province of Antroquia; they are almost entirely crystalline, like those of California. The forms of the crystals of titaniferous oxide of iron and zircon, are even in a better state of preservation. These sands are rather gray than black; also the magnet gave me from 6gr. 70 of sand, only 2gr. 30 of oxide

of iron, or 34·35 per cent.: there remained, after this first operation, a sand composed of titaniferous oxide of iron, specular iron, zircon, and quartz. The first two minerals, although very abundant, are not nearly so plentiful as in the Californian sand. I have not here counted the grains, the smallness of many of them having rendered this operation difficult. I simply estimated them by sight, separating from them as much as possible, under the microscope, the grains of a different nature. According to this estimation they were composed of—

Magnetic oxide of iron obtained exactly	34·35
Titaniferous oxide of iron and specular iron	15·00
Zircon	20·00
Quartz	25·00
Corindon	1·00
Rock of a grayish yellow, opaque, probably quartz, iron pyrites and gold	4·65
	100·00

Among the crystals of titaniferous oxide of iron and specular iron, a certain number have preserved easily appreciable forms. They have, in general, much lustre: the crystals of zircon, for the most part very clear, are frequently terminated at their two extremities; they possess the red orange color proper to that mineral. These crystals are longer than those of California; their forms, although the same, differ, however, essentially in the difference of the extension of the faces. These are four-sided prisms, h', surmounted by a long dioctohedron, and terminated by very short facettes, a'. They are perceived only in the projection of the crystals, by an obtuse point which terminates them.

The quartz, almost always fragmentary, is little rounded; some crystals are even observed in it terminated at their two extremities.

It may be said in general that the auriferous sand of New Granada is less rounded than that of California, from which it may be presumed that it comes from a less distance. In fact, in comparing the distance of the Andes from the Valley of Rio Dulce, we find it to be only 80 kilometres (about 50 miles), whilst we have seen that the Valley of the Sacramento was nearly 400 kilometres (about 250 miles) long. The sands of New Granada are less rich in oxide of iron than those of California, which might be owing to their washing not having been pushed quite so far; these are the only differences which have been observed; their composition is, on the contrary, identical. From this it may be concluded that the mountains which have produced them by their denudation, are of the same nature, and that the Andes, for a length of more than 4,800 kilometres, present a complete identity. The regularity of this chain, which forms everywhere the barrier of the great ocean, naturally gave this idea; but the proof of the material fact is not the less interesting, and the study of the sand shows us their identity, even in all the details, which geology is not always in a condition to observe, for the minerals which they contain are disseminated in an inappreciable manner in the rock, whilst the diluvial phenomena which have at once isolated them from the rock, and concentrated in the earth, offer an easy means of studying them.

(*To be concluded in our next.*)

OBSERVATIONS ON THE USE OF THE SESQUIBASIC PHOSPHATE OF SILVER IN MINERAL ANALYSIS, AND IN ORGANIC ANALYSIS FOR THE DECOMPOSITION OF THE ALKALINE AND EARTHY CHLORIDES.*

BY M. J. L. LASSAIGNE.

We owe to Chevevix the use of sesquibasic phosphate of silver for separating chloride of barium from chlorate of baryta, in the preparation of the latter salt. It was by this process, now almost abandoned, that this salt was first obtained in the laboratories in a pure state, so that its principal qualities could be studied.

The decomposing action exercised by hydrated sesquibasic phosphate of silver on alkaline and earthy chlorides induced us to try this metallic salt—1st, for isolating certain nitrates of the alkaline and earthy chlorides; 2nd, for separating the saccharine principles mixed with chloride of sodium, as met with in certain organic products.

The first means were employed by us in an analysis of water from a well. It is known that the salts soluble in concentrated alcohol consist principally of chlorides of magnesium and calcium, frequently associated in a greater or less degree with nitrates. Being desirous of ascertaining the proportions of nitrate of magnesia and chloride of magnesium in a mixture obtained with alcohol from the residue of some water from a well near Paris, we tried the use of hydrated phosphate of silver on a solution of these two salts. We soon found that, by the application of a gentle heat, the chloride of magnesium was completely converted into

* *Comptes Rendus*, No. 7, Aug. 13, 1849.

chloride of silver and sub-phosphate of magnesia, insoluble in water; whilst the nitrate remained in solution and was obtained by the evaporation of the solution. This simple method may be used in a great many circumstances: it succeeds equally well with a mixture of nitrate of lime and chloride of calcium, as we have distinctly proved. A small quantity of phosphate of silver remains dissolved in the water with the alkaline nitrate; but it is very trifling, and is easily allowed for in a quantitative analysis. The separation of an earthy nitrate from a chloride can be well effected only by evaporating to dryness the solution, in which must be an excess of hydrated phosphate of silver, and treating the residue with cold distilled water, so as to remove the insoluble products by filtration.

It was by operating thus that we were enabled to estimate precisely the small quantity of nitrate of magnesia which was mixed with chloride of magnesium in the residue of some water from a well. We think that this process may be used with advantage to perform analogous separations in the analysis of mineral waters.

We have made another application of this same phosphate of silver in the separation of cane and grape sugars, mixed with a small quantity of chloride of sodium. These two substances, soluble in alcohol, are sometimes met with mixed in certain organic products. The action of the phosphate of silver on a solution of such a mixture, forms, at the ordinary temperature, insoluble chloride of silver, and soluble phosphate of soda, which remains mixed with the sugar. Now, the phosphate of soda being insoluble in alcohol at 88 degrees, whilst sugar, on the contrary, is soluble in it, the possibility of effecting a separation by acting with alcohol on the product evaporated to dryness, is evident. Direct experiments have convinced us that cane and grape sugars, thus separated, retained merely a trace of the chloride of sodium which had been purposely mixed with them. In acting without heat and promptly on easily soluble principles, to separate the chlorides they may contain, there is no reason to fear the reducing action of the organic matter on a portion of phosphate of silver.

ESTIMATION OF CARBONIC ACID IN MINERAL WATERS.*

BY M. LIMOUZIN-LAMOTHE.

It is not without some difficulty that chemists called upon to analyse the water of a gaseous spring are able to ascertain exactly the volume of carbonic acid gas contained in it. This estimation cannot be made with accuracy in the laboratory; indeed, it is necessary to know the volume of gas contained in the water of the spring itself, and not that which may be left in the same water after having remained for any time in bottles. Whatever precautions may be used to prevent escape—however rapidly the vessels may be filled—whatever care we may take in the selection of stoppers, sealing the bottles, &c., we always find, in an analysis made in the laboratory, less gas than in one made at the spring.

The means ordinarily employed are the mercurial bell-glass receiver, or boiling under the bell-glass, processes whose actual accuracy we do not dispute; but if we consider the inconveniences already noticed, and add the further loss of gas during the opening of the bottle and the pouring of the liquid into vessels for the experiments, it must be admitted that the quantity found will be merely a few fractions, and that it will be impossible to ascertain the exact amount of gas contained in the spring water.

On the other hand, it is impossible, at least in the majority of cases, to convey to the spring the apparatus indispensable for making on the spot the necessary experiments. Mercurial troughs, especially, may be regarded as immoveable; besides, they are not in all laboratories, nor within the reach of practitioners of small localities. This removal would occasion in all cases some expense.

A much more simple process, as easy, more convenient, and within the reach of every one, may, it appears to me, be employed with success.

Before proceeding to estimate the carbonic acid gas, it is necessary to prepare, in a large vessel—a boiler for instance—a sufficient quantity of lime water. The lime must be quite fresh, and the water must be filtered. It may be poured into bottles, which must be perfectly fitted and corked immediately.

After having done this, one or two quarts of the lime water are poured into a suitable vessel of sufficient capacity, and immediately after one quart of the gaseous water just taken from the well. It is useful to receive the mineral water into a measure capable of containing exactly a quart, and not into a bottle, in order that the water may undergo as little agitation as possible during the mixing of the two liquids. This mixture is continued alternately for several quarts, and the action of the gas on the carbonate of lime obtained is verified. If the quantity of gas contained in the mineral water is considerable, the excess of gas re-dissolves the car-

* *Journal de Chimie Médicale*, Sept., 1849.

bonate of lime precipitated. In this case, a superabundance of lime may be added to effect the absorption of all the free gas contained in the mineral water. If the precipitate is abundant, the alternate addition of lime water and mineral water is continued until the latter amounts to 10 quarts. After the mixing has been well effected, and the combination of the carbonic acid has taken place, the precipitate obtained is allowed to subside, and more lime water is added to ascertain that all the gas is saturated. If by this addition a further precipitate be formed, more lime water must be added, until it exists in excess and occasions no further precipitate. This being ascertained, the liquid is left to settle for a short time, and when the precipitate is deposited all the water is decanted, as far as possible, carefully avoiding any waste of the carbonate produced. The precipitate is collected in a filter whose weight has been noted. As soon as the water has perfectly drained off, the product is washed on the filter with pure water (not gaseous) in order to remove the excess of lime water, which, becoming saturated by the gas contained in the atmospheric air, would interfere with the accurate appreciation of the carbonate of lime obtained by acting, as above, on the spring water.

The precipitate contained in the filter is perfectly dried, after which it is weighed, and the weight is noted, the tare of the filter being deducted.

In this operation the lime dissolved in the water combines with the carbonic acid gas, producing insoluble carbonate of lime. This carbonate precipitates, but not alone: the mineral water, deprived of one of its constituent principles, deposits at the same time the other insoluble carbonates, lime, magnesia, and iron. It retains only the soluble salts, which are removed by decantation and washing.

This first operation being completed, the analysis of the other substances, besides carbonic acid contained in the mineral water, is continued according to the ordinary methods, subtracting from the known weight of the lime precipitated that of the insoluble carbonates. If the mineral water contains, as is most frequently the case, bicarbonate of soda or potassa, these salts also augment the produce of carbonate of lime precipitated. These alkalies abandon their carbonic acid gas and become caustic. It is necessary, therefore, to take account of their action on lime water, and to deduct, by calculation, the carbonate produced.

These subtractions being made, there will remain only the carbonate of lime produced by the free carbonic acid of the mineral water, and from this precipitate it will be easy, by means of a simple rule of proportion, to ascertain the volume of gas contained in the precipitate obtained, or, in other words, in 10 quarts of gaseous water.

Five grammes of carbonate of lime being equivalent to 1 litre and 21 centilitres of carbonic acid gas, the whole may be easily appreciated. Example:—

	Grammes.
Precipitate obtained from 10 *litres* (quarts) of gaseous water, with sufficient lime water to completely saturate it	28 75
Deduct the carbonate of lime produced by the normal salts contained in the gaseous water	2·25
Remaining	26·50

5 : 1 lit. 21 : : 26.50 : x = 61. 313.

The 10 litres, therefore, contain 6·313 lit. of free gas, or 0·6313 per litre.

When the object is limited to ascertaining the quantity of carbonic acid contained in the mineral water, the operation is very much simplified: it is then sufficient to boil for a short time 10 litres of the same water. The disengagement of the gas effected during the boiling precipitates the insoluble carbonates held in solution. The latter are collected on a filter previously tared, then they are dried and weighed. The product of the filtration is evaporated to dryness, and the quantity of bicarbonate of soda or potassa originally held in solution in the water is appreciated; from these results we determine by calculation the carbonate that this salt produced with the lime water; this product is added to the carbonates deposited during the ebullition of the water, and subtracted like those of the first precipitate. Example:—

	Grammes.
Precipitate obtained from 10 litres of gaseous water, with sufficient lime water to completely saturate	24·25
Deposit produced by boiling	2·50
Carbonate produced by the carbonate of soda or potassa	0·75
Carbonate produced by the carbonate of soda or potassa	3·25
Remainder	21·0

5 : 1·21 : : 21 : x = 5·8.

Ten quarts contained, therefore, 5·8 litres of free gas.

ON A CHROMATE OF COPPER AND POTASSA.*

BY A. KNOPP.

This salt forms a pure light-brown powder, iridescent in the sunshine, consisting of transparent microscopic six-sided plates. It is

* *Annalen der Chemie und Pharmacie*, April, 1849.

nearly insoluble in water. In carbonate of ammonia and caustic ammonia it dissolves, forming a deep green solution: a hot saturated solution, on cooling, parts with a salt in brilliant green prisms, with a tint of golden yellow, which appears to be the chromate of ammonia and copper produced by M. Malaguti by another process.

This double salt of potassa is instantly formed, when recently precipitated hydrated oxide of copper is mixed with bichromate of potassa in solution; it may also be obtained by mixing a solution of sulphate of copper with a solution of bichromate of potassa in excess, caustic potassa being gradually added. The precipitate, first of a pale color, afterwards becomes darker and crystalline.

This salt, on being burned, yields water and oxygen, and a mixture of oxide of copper, oxide of chromium and chromate of potassa remains; the latter may be, at least, partially dissolved out by means of water. To analyse this salt it was dried over sulphuric acid, and dissolved in hydrochloric acid; the copper was separated by means of sulphuretted hydrogen, and weighed in the manner usually adopted for calcined oxide of copper. The liquid filtered from the sulphuret of copper was boiled in order to expel the excess of gas, and the oxide of chromium was precipitated with ammonia. When completely separated by long boiling, it was collected in a filter, ignited and weighed, and calculated as chromic acid. The solution filtered from it was evaporated to dryness, and the salt was heated in a platinum crucible, to volatise the hydrochlorate of ammonia. The potassa was then weighed as chloride of potassium.

In three analyses, made respectively with 1·478, 1·666, and 0·944 grammes of salt, prepared at different times, the following proportions were obtained:—

Chromic acid ..	43·549	42·665	43·261
Oxide of copper	36·814	37·135	35·916
Potassa.....	13·735	13·834	14·000

These numbers correspond, for the anhydrous salt, to the formula—PO, $Cr\,O^3$ + 3 CuO, 2 CrO^3. The chromic acid in the chromate of copper being converted by calcination into oxide of chromium, it must lose three atoms of oxygen, or 6·732 per cent. The amount of water may be determined from the difference in the two by ignition. 6·357 grammes of salt lost by calcination 0·905, or 14·236 per cent. of water and oxygen. An experiment with 1·382 grammes of salt gave 13·821 per cent. loss. The 6·732 of oxygen being deducted from the 14·236 gives 7·504 water, in which the oxygen is equal to that in the oxide of copper: and, consequently, corresponds to three atoms. Theory shows that the salt should lose by ignition 14·580 per cent. of water and oxygen, which is a sufficient approximation to the amount found.

The salt before ignition may, therefore, be represented by the formula PO, CrO^3 + 3 CuO, CrO^3 + 3 HO, which would probably be more correctly expressed by (PO, CrO^3, + 2 CuO^3 + CuO, HO) + 2 HO. The corresponding composition per cent. is:—

Chromic acid	43·878
Oxide of copper	34·579
Potassa	13·695
Water	7·848

NEW PROCESS FOR DETECTING IODINE AND BROMINE.*

BY ALVARO REYNOSO.

THE means employed for detecting these bodies, when they exist in the form of iodides or bromides, consists in dissolving them in water, adding starch in the state of paste, or ether, and a few drops of an aqueous solution of chlorine. The chlorine seizes the metal combined with the iodine or bromine, and these bodies color the starch blue, or dissolve in the ether: but, as iodine and bromine have the property of combining directly with chlorine, forming chlorides of iodine and bromine, indicating the presence of these bodies, chlorine should not be used in excess, because the chlorides of iodine and bromine are decomposed by contact with water, producing hydrochloric and iodic or bromic acids, which have no action on starch or ether.

This experiment was very difficult to perform: frequently when it was desired to find these bodies, they were not found. It was believed that this was owing to the above inconvenience. The quantity of chlorine was then diminished, in the fear of exceeding the necessary proportion, and it happened that the quantity of chlorine was not sufficient for liberating the iodine. The manner in which chlorine was employed also led to error; indeed, it is known that a solution of chlorine weakens with time, and that it ultimately disappears altogether, despite all possible precaution. Thus, on pouring into the solution of an iodide or bromide a small quantity of chlorine water, it happened that the iodine was not set free, and that all the chlorine was employed in forming hydrochloric acid. This method was not, therefore, applicable to the detection of small quantities of iodides or bromides, especially when mixed with solutions capable of taking the chlorine. Hence it was desirable to iso-

* *Annales de Chimie et de Physique*, Vol. xxvi.

late iodine and bromine by means of a body incapable of acting on them, even in excess. Oxygenised water entirely fulfilled these conditions. It decomposes hydriodic and hydrobromic acids, without having any action on the iodine and bromine liberated.

The following is the process for iodine: a piece of binoxide of barium is put into a small tube closed at one end: distilled water, pure hydrochloric acid, and the paste of starch, are added when bubbles appear on the surface and the iodide. A rose-blue color is instantly perceived when the quantity of iodine is rather considerable, and of a deep blue when the quantity is great.

It is more convenient to operate in these conditions, for both the ease and success of the experiment. In this manner we are safe in employing an excess of oxygenised water, which is necessary where hyposulphites, sulphites, or sulphurets exist; besides, the hydrochloric acid employed in the preparation of the oxygenised water also performs an important part, for it serves to liberate the hydriodic acid:—

$BaO^2 + (Cl\ H)^2 + IH$, $PoO + HO = BaO$, $C^1l\ H + PoO$, $C^1l\ H + 2\ (HO) + I$.

Although it is beyond doubt that hydrochloric acid, in acting on the deutoxide of barium, in presence of water, produces oxygenised water, I desired to ascertain that it was indeed $H\ O^2$ that produced the result obtained: I then substituted tartaric acid for the hydrochloric acid, and I attained the same end. M. Thenard, moreover, had noticed the composition of hydriodic acid by pure oxygenised water.

When the iodides are mixed with chlorides, sulphurets, sulphites, or hyposulphites, the process is quite as accurate; only, as by the action of the hydrochloric acid on the sulphuret, sulphuretted hydrogen is produced, which is decomposed by the oxygenised water, and on the hyposulphites acid sulphites pass to the state of sulphate absorbing oxygen, a greater quantity of oxygenised water is required than if the iodide were pure.

The hyposulphites and sulphites, in passing to the state of sulphates, produce in the liquor a precipitate of sulphate of baryta, which might arrest the action if not stirred so as to detach the sulphate of baryta from the surface of the deutoxide of barium; moreover, this should always be done to increase the production of oxygenised water. By this process, I very readily detected the presence of iodine in the urine of a patient taking 0·10 centig. of iodide of mercury morning and evening. By means of chlorine, the same urine gave no result. This was a case in which, notwithstanding all precautions, the iodine passed unperceived by the chlorine.

This process detects the presence of iodides in the ashes of sponge. One drop of a solution of 0·010gr. of iodide of potassium dissolved in a quart of water, produced, every time that it was dropped into the tube, a very striking blue color on the surface. On stirring, the blue color disappeared, and the liquor assumed a rose tint; by adding another drop the blue color on the surface was again obtained. Thus this process very conveniently indicates the presence of $\frac{1}{10000}$ of iodide of potassium.

For bromine the process is the same, only ether is used instead of starch. It is stirred, the bromine dissolves in the ether, and gives rise to a yellow color, which is more or less deep according to the quantity.

The ether may be done away with, and starch used instead. We have then a reddish yellow precipitate throughout the tube, of bromide of starch. This means is more convenient. Bromine, in acting on starch, produces a true combination, and not a simple penetration, as M. Dupasquier supposes. (*Traité de Chimie*, tome i., 648.)

The proof that it is a combination is, that ether agitated with it does not acquire any color, and, consequently, does not decompose it; also, starch discolors ether holding bromine in solution.

If iodine and bromine did not both combine with starch, they might be separated by setting them free in the presence of starch: the iodine would combine with the starch, and the bromine might be dissolved in a little ether added to it, so as to obtain a blue color below and a yellow one above; but as both possess that property, and, as, moreover, bromide of starch is undecomposable by ether, we cannot operate in this manner.

We must, therefore, recur to M. Dupasquier's method, and employ it with all possible caution against errors. As bromine requires more chlorine than iodine to make it disappear, it is the less subject to inaccuracy.

ON THE EXTRACTION OF VANADIUM FROM ITS ORES AND SLAGS.

BY ISAIAH DECK, DUBLIN.

THE analysis of many varieties of slags, and furnace products, in searching for the rarer elements, and investigating the curious differences observed in the admixture with the baser metals, as regards malleability, ductility, &c., has led me to adopt a process for the extraction of vanadium, which, differing somewhat from those hitherto used, possesses an advantage in the readiness and certainty

with which it ensures the thorough separation of the chromium, which I have found in almost every instance associated with it.

The substance is to be well powdered, and mixed with a fourth of its weight of nitre, and heated in a reverberatory furnace at a cherry red for some hours. The shrunken coherent mass is digested in boiling water, and filtered. The filtrate is carefully neutralised with pure nitric acid, and precipitated with acetate of lead, adding sulphurous and dilute sulphuric acids until the resulting precipitate is white. Filter and boil with caustic potassa, which precipitates the chromium—filter and boil with hydrosulphate of ammonia, or precipitate in the cold with sulphuretted hydrogen—collect the precipitated sulphuret of vanadium and fuse at a low red heat with twice its weight of nitre—dissolve in water, filter, and immerse sticks of muriate of ammonia in the solution for three or four days. The crystals of vanadiate of ammonia separate in a granular form, and may be purified by re-crystallisation, or converted into vanadic acid by the application of a low red heat.

I have found this rare metal to be much more diffused than is generally supposed—but in very minute quantity, and by the above process have lately detected it in a peculiar metallic-looking sand from the shores of Murray Bay, River St. Lawrence, in the form of a silicate of vanadic acid—combined, as usual, with small quantities of chrome and copper, and is probably derived from the detritus of the surrounding metaliferous rocks.

REMARKS ON BANCA TIN AND ON THE ATOMIC WEIGHT OF TIN.*

BY PROFESSOR MULDER.

The samples of Banca tin operated on by Dr. Mulder were presented by the Society of Commerce to be examined for the Government. It was the desire to obtain from Banca tin ore tin quite pure, with the exception of a little iron. The examination of twenty samples of Banca ore from different mines, imported in different ships, showed them to consist of almost chemically pure tin.

A piece was cut out of the centre of each sample, and oxidised with nitric acid, and then diluted with a small quantity of water before being filtered. This loss arising from the trifling solubility of the tin in the acid liquid was neglected as insignificant; it contained, besides, traces of iron, lead, and copper, but neither silver, antimony, nor arsenic. The insoluble oxide of tin was calcined and weighed. The results of his analyses are given below. The names in the first column are those of the vessels in which the various kinds were brought; the second contains the quantity of tin used for analysis; the third the amount of oxide of tin obtained upon oxidation with nitric acid; and the fourth the amount of pure tin, supposing that the oxide of tin contains in 100 parts 78·616 tin and 21·384 oxygen.

I.	II.	III.	IV.
1 Jacob Cats	8·597	10·9335	99·99
2 Elise	8·841	11·2630	100·15
3 Prins Hendrik	9·975	12·7130	100·19
4 Zeeland	11·181	14·2720	100·35
5 Cornelia	9·082	11·5500	100·00
6 Lucipara	12·009	15·2750	199·99
7 Prins Frederik	12·706	16·1620	99·99
8 Middleburg	13·443	17·0860	99·92
9 Clara Henriette	9·609	12·2080	99·88
10 Oud Alblas	8·764	11·1520	100.04
11 Doggersbank	10·080	12·8160	99·95
12 Stad Amsterdam	9·196	11·6920	99·95
13 Koniginn du Nederlanden	10·174	12·9270	99·88
14 Zeemanshoop	12·185	15·4790	99·87
15 Anna en Elise	9·304	11·8300	99·96
16 Josephina en Catharina	9·253	11·7590	99·91
17 Flora	8·090	10·2910	100·00
18 Christopherus Columbus	10·518	13·3790	100·00
19 Adm. Jan. Evertse	10·349	13·1660	100·01
20 Doctrina et Amicitia	8·521	10·8300	99·92
	201·877	256·7735	1999·96

* *Scheik Onderzoek*, Part V., No. 4., p. 250.

From the fourth column we obtain the arithmetical mean 1999·96 : 20 = 99·998, by which it appears that all these samples, considering how trifling the difference of the numbers is, are almost chemically pure tin, especially remembering that a little tin was left in the nitric acid solution. The solution from all the samples being mixed, deposited, when evaporated nearly to dryness, 0·210 of oxide of tin; and about 0·0061 grammes of oxide of tin was separated from the other metals in the residue. Now, since there were 201·877 grammes of tin taken for the twenty analyses (see column 2), and the amount of oxide of tin obtained therefrom was 256·7735 grammes (see column 3), we find, on adding to the latter number the oxide of tin subsequently obtained, that 201·877 grammes of tin give 256 9896 grammes of oxide of tin.

In the residue, from which had been separated the last quantity of oxide of tin, was found an amount of oxide of iron corresponding to 0 0395 grammes iron, oxide of lead corresponding to 0·0257 lead; oxide of copper to 0·0126 copper. Not a trace of any other metal could be found in the nitric solution, although tested for arsenic and antimony in Marsh's apparatus. According to this, Banca tin contains the following:—

Iron	0·0395	0·019
Lead	0·0257	0·014
Copper	0·0126	0·006
Tin.....	201·7992	99·961
	201·8770	100·000

From the excesses obtained (see column 4) we are justified in assuming that the atomic weight of tin requires some modification. With respect to the facts ascertained by experiment, there was obtained from 201·8770 grammes Banca tin, containing 201·7992 grammes pure tin, 256·9896 oxide of tin after the removal of the foreign metals, consequently 201·7992 grammes of pure tin have absorbed 256·9896 — 201·7992 = 55·1904 oxygen. If we calculate from this the composition of the oxide of tin for 100 parts, we find for 78·524 of tin 21·476 oxygen, which makes the atomic weight of tin 731·230, whereas Berzelius made it 735·296.

The above results had another object than ascertaining the composition of the Banca tin, and are, in consequence, not suited, especially from the numerous weighings, to establish the atomic weight of tin; but, as they indicated that the equivalent of tin was too high, some experiments were made with chemically pure tin, for this especial purpose, by Mulder and Vlaanderen, 100 parts of tin being given.

	Mulder.	Vlaanderen.	
	a.	a.	b.
Oxide of tin ..	127·56	127·56	127·43

Vlaanderen, moreover, analysed three other kinds of Banca tin, which contained about the same amount of foreign metals as the above-mentioned. Three oxidations of the first gave, for 100 parts of Banca tin respectively, 127·750, 127·707, 127·701 oxide of tin; 100 parts of the second kind furnished 127·50; and 100 parts of the third kind, 127·69 oxide of tin. These numbers differ but little, and from the coincidence of the analysis by Mulder and Vlaanderen, marked *a*, these would appear to be most trustworthy, and the atomic weight of tin would be 725·7. As, however, analysis cannot guarantee the value of 0·7, Mulder proposes, in order to obtain a whole number, to adopt 725, that is, 58 × 12·5 as the atomic weight of tin. The analysis *b* of Vlaanderen gave the number 729·2; nearly the same atomic weight as was deduced from the above twenty experiments (731·230). Admitting the equivalent 725, the composition of 100 parts of the oxide of tin would be—

Tin ..... 73·38
Oxygen ..... 21·62

ON BEE'S WAX.*

BY DR. VOGEL, JUN.

THE production of cerine and myricine from wax by means of boiling alcohol, having always given unsatisfactory results, Dr. Vogel, jun., employed chloroform, and found that from six to eight parts of this liquid poured on white wax, and left standing for some time at the ordinary temperature, always dissolved a quarter of the wax, leaving the remaining three quarters as residue. On evaporating the chloroform, a soft, clammy substance remains behind, which readily dissolves in chloroform. The undissolved wax is granular and very friable. It is, however, still undecided whether the two substances obtained in this way from wax, are or are not identical with cerine and myricine. Be this as it may, chloroform presents a convenient test for detecting the adulteration of white wax by tallow or stearic acid, since these substances are not readily dissolved by it at a low temperature. Consequently, if white wax, heated with from 6 to 8 times its own weight of chloroform, loses more than one-fourth, we may conclude that it is adulterated.

* Buchner's *Repertorium*.

ON THE PRODUCTS OF THE DISTILLATION OF LACTIC ACID AND LACTATE OF COPPER.*

BY DR. ENGELHARDT.

From highly concentrated lactic acid, at a temperature of between 266° F. and 284° F., a watery, acid, and rather empyreumatic liquid—dilute lactic acid—slowly distils over. When the heat has been kept up until no more liquid condenses, a brownish yellow residue—the anhydrous lactic acid of Pelouze—$C^{12} H^{10} O^{10}$, remains. When the boiling is assisted by rough substances, the hydrated acid can be boiled at 390° F., and distilled without decomposition; without such aid, whilst a quantity distils over which augments with the temperature, the rest is converted at from 356° to 392° F. into anhydrous acid.

Anhydrous lactic acid is very sparingly soluble in boiling water, imparting to it a bitter taste. In the state of the above residue, it is a solid amorphous, brownish, yellow mass, fusible below 212° F., and on cooling is so tenacious that it may be drawn out into threads; its taste is extremely bitter; it is soluble in all proportions, in spirit and absolute alcohol. The anhydrous acid may be precipitated from this solution in flakes, which by degrees unite in the form of drops. Long boiling or exposure to damp air restores it to the ordinary condition. This is speedily effected by the alkalies and earths. A temperature of 464° F. produces no change in this anhydrous acid; at 482° F. decomposition commences, and at 500° F. it terminates. This decomposition furnishes carbonic oxide, and from 3 to 4 per cent. in volume of carbonic acid, aldehyde, lactide, and citraconic acid, with some reproduced lactic acid; no hydrocarbons were found, nor were any lactones or acetones, asserted by Pelouze to exist, observed. From 1 to 2 per cent. of carbon was left in the retort.

When water is added to the distilled matter, to separate these substances, aldehyde and hydrated lactic acid are dissolved, and a transparent, yellowish, and at first very mobile oil subsides. After remaining some time in contact with water, this oil gradually decreases in quantity, disappearing entirely in a few days, leaving a few smeary crystals which also dissolve in time. This may be expedited by shaking or heating it with a large quantity of water. This oil is a mixture of hydrated lactic acid, citraconic acid, and lactide. No anhydrous acid distils over, as is proved by the fact that when the contents of the first receiver are solidified, and then treated with alcohol, which does not dissolve the lactide, water precipitates no lactic acid from the solution.

Aldehyde.—When the distilled matter, in the state of either liquid or crystalline paste is heated on a sand bath to 212° F., and the product received into anhydrous ether, kept cold, it yields, on ammonia being passed through it, aldehyde-ammonia.

Lactide.—The residue thus freed from aldehyde is a brownish liquid which generally solidifies into a crystalline paste, which is washed on a filter with cold absolute alcohol, and dried between folds of bibulous paper. Large crystals may be obtained by re-dissolving in a little boiling absolute alcohol, and setting apart to cool. That which does not crystallise by cooling is lost, being converted, by spontaneous evaporation and by heat, into common lactic acid. The crystals appear to belong to the rhombic system, and strongly resemble those of protosulphate of iron. Lactide cakes together at 248° F., and may be sublimed, but very slowly. Above this temperature it melts, sublimes more quickly, and at 500° F. furnishes the same products of decomposition as anhydrous lactic acid. Lactide, like that acid, acts on water and the alkalies and alkaline earths. It is re-converted into the hydrated acid. It is more soluble in boiling water than the anhydrous acid, and, on cooling, the greater part separates in small needles. It has no odor or taste, but, in assimilating water, it speedily acquires a very acid taste. Lactide, dried *in vacuo*, yielded—

C^6	49·87	50·00
H^4	5·67	5·56
O^4	44·46	44·44
	100·00	100·00

Citraconic Acid is produced in only small quantity. The alcohol used for washing the crystals of lactic acid contains this acid and lactic acid; it is filtered and distilled; the liquid which passes over at 430° F. is saturated with carbonate of baryta, when the salt, which is quite insoluble in alcohol, subsides as a crystalline paste. This is dissolved in boiling water, and the citraconate separates on cooling in beautiful pearly laminæ, which are obtained largest by concentrating the solution until a pellicle forms on the surface. The salt, dried in the air at 212°, lost five atoms of water. Thus dried, its composition was—

	Atoms.	Found.		Calculated.
Carbon	10	22·57	22·80	22·61
Hydrogen ..	4	1·81	1·93	1·51
Oxygen	6	18·15	17·40	18·09
Baryta	2	57·47	57·87	57·79

* *Annalen der Chemie.*

Lactic Acid is left in either the anhydrous or hydrated state in the retort, after the foregoing distillation of citraconic acid.

19·5 grammes of anhydrous lactic acid, exposed for eight hours to 500° F., gave the author 12·2 per cent. of aldehyde, 14·9 per cent. of lactide, and 1 per cent. of carbon. By raising the temperature to 572° F. and higher, the quantity of lactide and lactic acid were diminished, and the aldehyde increased. As the disengagement of the gas is much more violent, the gases must be more carefully cooled, to prove directly the increase of the aldehyde. The lactide produced is, for the most part, decomposed into aldehyde and carbonic oxide at this heat, which is much higher than the point of sublimation. The decomposition, therefore, of the lactic acid is simply as follows:—Lactide is first produced, and is decomposed at a higher temperature into 2 equivalents carbonic oxide and 1 equivalent aldehyde $C^4 H^4 O^2 + 2CO = C^6 H^4 O^4$. The presence of carbonic acid and the composition of citraconic acid seem to show that in the distillation a substance containing more hydrogen is formed, but it could not be isolated.

Lactate of Copper, submitted to distructive distillation, presents two stages of decomposition. In the first, at between 392° and 410° F., carbonic acid and aldehyde, and a little hydrated lactic acid are formed, the latter very likely owing to the crystals having retained some water of crystallisation. The retort contains metallic copper, and anhydrous lactic acid, which decomposes in the second stage at between 480° and 500° F. Lactates of powerful bases are decomposed differently. Dr. Engelhardt recommends the dry distillation of lactates of feeble bases for the preparation of aldehyde.

ON AMDULIN: A MODIFICATION OF STARCH.*

Schulze found that when starch is acted on in the same manner as for the production of dextrine, but the boiling interrupted by the addition of sulphuric acid when the starch is dissolved, and the hot liquid immediately neutralised with carbonate of lime, in a few days flocculi deposit from the perfectly clear liquid, and may easily be separated by filtration. When dry they have the appearance of white sago, and the composition of starch. Schulze calls it *amdulin*. It has the same action as starch on iodine, but differs from starch in being completely soluble in hot water.

* *Pharmaceut. Central Blatt.*

ON THE COMPOSITION OF STEARINE.*

BY G. ARZBAECHER.

The author was led by the irreconcileable statements concerning the composition o stearine in Gmelin's *Handbuch der Chemie*, to perform several combustions of stearine prepared from mutton and beef suet.

The stearine was prepared by melting each part in a water bath, and agitating with ether. The beef melted at 117° and the mutton at 122° F. The ether, after cooking, was poured off, and the stearine was pressed. This treatment was repeated four or five times. Thus prepared, the melting point of each stearine was found to be uniformly 141° F.

Beef stearine yielded as a mean of four analyses, which agree well with those of Gay Lussac, and Lecanu, as will be seen from the following table:—

	Arzbaecher.	Chevreul.	Lecanu.
Carbon ..	78·74	78·78	78·74
Hydrogen	12·27	11·77	12·37
Oxygen ..	8·99	9·45	8·99
	100·00		

Mutton stearine, furnished as the mean of four analyses, which agree with those of Liebig and Pelouze:—

	Liebig.	Pelouze.
Carbon .. 76·50	76·60	76·50
Hydrogen 12·28	12·29	12·28
Oxygen .. 11·22	11·11	11·22
100·00	100·00	100·00

Oxygen was employed towards the end of all the combustions. The author was careful to obtain the stearine very pure.

From these results it would appear that beef stearine consists of one atom of glycerine with two atoms stearic acid, less eight atoms of water, and mutton stearine of one atom glycerine, and two atoms of stearic acid, less four atoms of water. The formula of the two stearines would be as follows:—

Beef Stearine.		Mutton Stearine.	
C^{142}	78·74	C^{142}	76·21
H^{134}	12·39	H^{126}	12·34
O^{12}	8·87	O^{16}	11·45

One hundred parts should furnish, therefore, by saponification—

	Beef.	Mutton.
Stearic acid	98·15	94·90
Glycerine.....	8·50	8·28

* *Annalen der Chemie und Pharmacie.*

ATOMIC WEIGHT OF LANTHANIUM.*

BY M. MARIGNAC.

M. MARIGNAC has recently revised the atomic weight of lanthanium. His experiments have led him to assign to this metal the equivalent number 588—O=100, or 47·04 H=1.

	O=100	or H=1
M. Choubine adopted the No.	451·88	36·15
Rammelsberg	554·88	44·39
Mosander	580	46·40
Hermann	600	48·00

Hermann denied the existence of didymium, and did not free the lanthanium from it. Consequently his atomic weight must be too high.

ATOMIC WEIGHT OF DIDYMIUM.†

BY M. MARIGNAC.

BEING unable to find any means of detecting the presence or the absence of lanthanium in sulphate of didymium, the author confines himself to enumerating the results of the determination of the equivalent of this salt, made with several samples after repeated crystallisation. The results of four experiments were—

Experiment I.	1210·4
,, II.	1206·9
,, III.	1218·7
,, IV.	1219·9

The closest approximation to accuracy we can make is to call the equivalent at least 620—O=100 or 49·60 H=1.

CONSTITUTION OF LEUCINE.

BY PROFESSOR MULDER.

MM. GERHARDT, Laurent, and Cahours, stated that Mulder found 1 per cent. less carbon than his formula required, which is not the case. His analyses give (C=6, H=1) a loss of only ½ per cent.

Gerhardt and Laurent found the following results, and they agree with those of Cahours (average of four analyses) :—

	Ger. and L.	Cahours.		
Carbon	54·60	55·05	12	54·9
Hydrogen ..	9·99	10·05	13	9·9
Nitrogen ..			1	
Oxygen....			4	

If theirs were correct there must have been a great loss of hydrogen in Mulder's former analyses. Consequently he has repeated them, and has again found less hydrogen. The results, compared with theory, are as follow :—

Carbon	54·9	54·8	55·7	12	55·4
Hydrogen ..	9·3	9·2	9·2	12	9·2
Nitrogen ..	10·5	..	..	1	10·7
Oxygen....	..	..	..	4	24·7

According to Mulder nitroleucic acid should have the formula—

$$C^{12}\,H^{12}\,NO^4 + NO^5,\,HO.$$

Messrs. Laurent and Gerhardt make it—

$$C^{12}\,H^{13}\,NO^4 + NO^5,\,HO.$$

M. Rost Van Tomniger proved similar results.

Vlaanderen has also confirmed this formula, which must be adopted as the correct one.

REDUCTION OF CHLORIDE OF SILVER.*

BY M. WETTSTEIN.

THIS chemist having made some experiments to determine the comparative value of the methods of reducing chloride of silver hitherto employed; namely, with carbonate of potassa, caustic potassa, sugar and caustic potass, zinc, iron, caustic lime and rosin, a mixture of caustic lime with charcoal, and charcoal alone, found the last mentioned the surest, simplest, and most economical. Two parts of chloride of silver and one of damp powdered charcoal are mixed and pressed into a black lead crucible, which is then covered with a piece of tile; during the calcination a hydrochloric acid gas is given off; after this ceases, the calcination is continued from 15 to 20 minutes. A carbonaceous mass results, from which the silver is dissolved by nitric acid of sp.-gr. 1·20, and gently heated towards the conclusion of the operation. The charcoal powder is not washed too long, as the last portions of silver adhere so obstinately to it that an inconvenient quantity of water would be required. The remaining charcoal, which still contains some chloride, must be dried and preserved for the next operation.

The impurities of the solution of silver are insignificant, and may be diminished by employing lamp-black.

To obtain the silver in the metallic state the crucible must be heated much higher.

The author attributes the production of hydrochloric acid to the combination of the hydrogen always present in charcoal with the chlorine.

* *Bibliotheque Universelle de Génève*, May, 1849.

† *Ibid.*

* Buchner's *Repertorium*.

SEPARATION OF NICKEL AND COBALT.*

BY PROFESSOR WÖHLER.

In Professor Liebig's mode of separating nickel and cobalt, by pouring the two metals into potassio cyanides, and precipitating the nickel by means of peroxide of mercury, protonitrate of mercury may afterwards be employed for precipitating the cobalt, and ascertaining its weight in a direct manner. The liquid from which the nickel has been precipitated by peroxide of mercury, and which contains the cobalt in the state of cobalto-cyanide of potassium, is carefully neutralised with nitric acid, and a solution of protonitrate of mercury, as neutral as possible, added. All the cobalt is precipitated as cobalto-cyanide of mercury, in the form of a dense white precipitate, which is readily filtered and washed. It then requires only to be heated in the air to convert it into black oxide of cobalt.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

PHOTOGRAPHIC INVESTIGATIONS.†

BY M. BLANQUART EVRARD.

I have the honor of submitting to the Academy Photographic proofs on paper, obtained by means of a matrix of albumen. The idea of employing albumen, rendered sensible to the action of light by mixing it with aceto-nitrate of silver, and spread in a fine layer on a plate of glass, belongs to M. Niepce, of St. Victor. It is the most complete confirmation of the principle of the deep impregnation of papers by the photographic substance, a principle which I had laid down previously in a communication to the Academy. "The deep impregnation of the chemical elements in the paste of the paper," I said then, "in such a manner that this paste becomes a medium in which may be accomplished the chemical re-actions which finally constitute the photographic image, is a consideration most essential to the success of the operation." (*Comptes Rendus de l'Academie*, vol. xxiv., 117.)

In proposing to substitute for the paste of paper a completely transparent and solid body which might contain the chemical elements, M. Niepce, of St. Victor, opened a new view to photography on paper. Responding to the appeal which he made to experimenters for arriving at practical results, I now submit to the Academy a method which combines all the conditions necessary for the industrial application of photography: for the matrixes on glass, by the preparations obtained on glass which I am about to describe, are unalterable in the light, do not lose any of their qualities after an indefinite number of drawings, are susceptible of being reconstituted, if accidentally lost, provided that we have a single proof of the lost matrix, and, finally, at all times, in all temperatures and conditions of light, they give satisfactory results.

As to the quality of the proofs, I propose to send successively to the Academy results to obtain its opinion. I now confine myself to those which appear to me necessary for proving that photography is capable of the production of models, in the very characters of those models: thus, I now present the proof of a miniature portrait produced, of the same size as the original, and in the light and transparent conditions of this sort of painting; a proof after an oil painting in opposite characters, vigorous shades and brilliant lights; a view from nature, with figures (white cows); and a bronze statue of remarkable finish and model; and, lastly, a copy from an engraving of the same dimensions, uniting, notwithstanding this great difficulty, delicacy, model, and vigor.

The following are the preparations:—Collect in a deep vessel a certain number of whites of eggs; remove every thing solid or not transparent; avoid also all dust, which would cause stains. Add 15 drops of a saturated solution of iodide of potassium. Beat up the eggs into a snow, and allow this snow to to rest until it resumes the liquid state. Clean the glass to be used with alcohol, place it on a support, and pour on it a sufficient quantity of albumen. Spread this albumen over the surface of the glass, using for this purpose a piece of glass, in such a manner that its cut side remains in contact with the surface of the glass. Give it several coats. This operation has for its object to put the albumen in perfect

* *Annalen der Chemie und Pharmacie.*

† *Comptes Rendus*, No. 8, 20th August, 1849.

contact with the surface of the glass, so that it may be well covered when the excess is run off at one of its corners. After this last operation, the glass is placed in a cool position, and allowed to dry.

The albumen being well dried on the glass, it must be subjected to a very high temperature (or very great cold, which has the same effect). Thus made ready, the glass may be submitted to the acetonitrate (in the proportion indicated in my communication of the 25th of January, 1847). The contact of the aceto-nitrate with the albumen must be made at one time, for the albumen contracting on its combination with the aceto-nitrate, there would be as many separations in the layer as repetitions of the immersion. The following is the most easy means:—Pour into a glass vessel, larger than the albuminised glass, aceto-nitrate, to the depth of half a centimetre, and afterwards give the vessel an inclination of 45 degrees. All the liquid being thus collected in the lower part, the edge of the glass, with the albuminised side, on the bottom of the vessel; then, by one and the same movement, let the glass fall into the vessel, and place it on the table in the horizontal position. This done, the glass is immediately removed and plunged into another containing water; agitate briskly for a few seconds, then take it out, and let the water run off, holding it by one of its angles, and striking the other sharply on the table.

Glasses thus prepared are photogenic; they may be employed indifferently in the humid or the dry state, if in case of having to operate at a distance or on a journey. In the same way, the proof may be produced after exposure to the camera obscura, either immediately or on return from a journey.

This operation is practised, as I indicated for paper in my communication of November, 1847, by plunging the glass in a bath saturated with gallic acid; however, to give to the proof all its value, it is advisable to add to the bath a little aceto-nitrate of silver. It will be prudent to take the proof out of the gallic acid before its various parts have acquired the desired tone; for, if the action were pushed too far we could not weaken the too-deep tones which they would present, whilst, if its shades were too weak, we might, without inconvenience, submit it again to the action of gallic acid, even should the matrix have served for producing a great number of proofs.

After this operation the glass should be washed in a large quantity of water, and afterwards passed into a solution of bromide of potassium (30 grammes in 100 grammes of water), then washed again in a large quantity of water, and finally dried by keeping it extended horizontally in the camera obscura, if the layer of albumen has formed some streaks, and is raised in places, through the various immersions which it has undergone.

Thus treated, the albumen acquires on the glass extreme hardness and solidity, so that when an incomplete proof has to be destroyed, in order that the glass may be used again, it is necessary to have recourse to a very energetic chemical agent, such as cyanide of potassium, to remove it completely.

The positive proofs were obtained in the same manner as the clichés on paper.

IMPROVEMENTS IN MANUFACTURING CERTAIN COMPOUNDS OF LEAD.—PATENT GRANTED TO HUGH LEE PATTINSON.

The patentee commences his specification by stating that he has discovered that when half an equivalent, or thereabouts, of lime, soda, potash, ammonia, or barytes is added to 1 equivalent of chloride of lead, both in solution, the whole of the lead is precipitated as a definite compound of 1 atom of chloride of lead and 1 atom of hydrated oxide of lead, which, when dried at 212° F. or under, has the composition just stated, or Pb Cl+Pb O, HO; but when dried at a temperature varying from 212° to 350° F., it loses more or less of the atom of water, and becomes or approaches to Pb Cl+Pb O. If less than half an equivalent of the alkaline precipitant be employed, the same definite oxychloride of lead is precipitated, but some of the chloride of lead remains in solution. The oxychloride of lead thus produced possesses a brilliant white color and great "body" qualities, which render it an excellent pigment, and useful for most purposes to which white lead is applicable.

The invention consists in the manufacture and application of this oxychloride of lead, or such compounds of oxide of lead and chloride of lead as shall result from the following mode of manufacture:—The patentee states that lime will answer as well for the purposes of this invention as any of the other alkaline precipitants above-named, and he prefers using it on account of its cheapness. He first makes a saturated lime water, by throwing an excess of slaked lime into a tub, filling the tub with water, and allowing it to stand until it becomes clear. The clear liquor will contain 1 part of lime in from 770 to 780 of water; therefore one cubic foot of water will contain 567 or 568 grammes of lime. A solution of chloride of lead is then made by dissolving it in boiling water,

in the proportion of 1 lb. of pure chloride of lead to $1\frac{1}{2}$ cubic foot of water. As some water contains earthy salts (sulphates or carbonates, or both) which precipitate lead, the patentee prefers to use such an excess of chloride of lead as will compensate for this loss. The solution is prepared by introducing the chloride of lead and boiling water into a wooden barrel, provided with a revolving agitator, and then it is run into cisterns to settle. The clear solution of chloride of lead is mixed while still warm (because if allowed to become cool it would deposit some of the chloride of lead) with an equal bulk of the lime-water; on this taking place, the insoluble oxychloride of lead is immediately formed and speedily settles to the bottom of the cistern, leaving a clear supernatant liquor (a weak solution of chloride of calcium); and after this liquor is drawn off the precipitate is collected and dried.

As the operation of mixing the lime-water and the solution of chloride of lead requires to be performed in an instantaneous manner, the patentee prefers to employ for this purpose two tumbling-boxes, of about 16 cubic feet capacity, which are charged with the two liquids, and simultaneously upset into a cistern, in which the oxychloride of lead is instantaneously formed, and from which the mixture flows into other cisterns when the oxychloride subsides,

The patentee states, that although he has only mentioned pure crystallised chloride of lead in the description of the process, yet it is not absolutely necessary that it should be in this form; for a rough chloride, made from lead ore, and its equivalent of muriatic acid, boiled to dryness, will answer, provided it be well washed, to free it from chlorides of iron, manganese, or other bodies likely to injure the color of the oxychloride. The exact proportion of pure chloride contained in the rough chloride should be ascertained previous to use, in order that the proper quantity may be mixed with the lime-water. If, however, a solution of chloride of lead of uncertain strength is obtained, or lime-water not quite saturated, they can be used with but little disadvantage, for it is only necessary to be careful not to add an excess of lime (*i.e.*, not more than the half equivalent), which can be easily ascertained after a few trials by filling the lime or lead tumbling-box more or less with its respective solution, as the trials may direct.

The patentee says, that it will not be necessary to describe any particular mode of proceeding with soda, potash, ammonia, or barytes, for if ever it should happen that these bodies could be used in preference to lime, it would be merely necessary to make a solution of each of known strength, and to use it with chloride of lead in the same manner as the lime-water.—Sealed February 14, 1849.

INVESTIGATIONS ON THE NATURE OF THE MINERAL SUBSTANCES NECESSARY FOR THE DEVELOPMENT OF A VEGETABLE.*

BY THE PRINCE OF SALM HORSTMAR.

The Prince communicates the result of some interesting investigations which he undertook concerning the inorganic substances which were necessary for the development of a plant.

To determine these mineral substances with accuracy, the first condition necessary to be fulfilled was to find a medium which was perfectly free from inorganic matters in which seeds might be made to germinate. The author fixed on the charcoal arising from the calcination of the purest and whitest sugar-candy. This charcoal had been prepared on a porcelain plate, placed in the muffle of a reverberatory furnace, which was safe from the introduction of cinders. The product was powdered and calcined a second time before being used, in order to destroy all traces of carburets of hydrogen, which are prejudicial to vegetation. The author used oats in all his experiments, and this selection was made on account of the importance of the plants belonging to the family of gramina, and of the fact that, even in a room, the oat gives ears capable of ripening.

The experiments were made in tin vessels of $5\frac{1}{2}$ inches high, $2\frac{1}{2}$ inches broad at the top, and $\frac{1}{2}$ at the bottom. These vessels were covered on the inside with white wax, to preserve the roots from contact with the metal. Into each of these vessels was introduced 75 grammes of sugar charcoal, with which was mixed the mineral matters whose influence on vegetation it was desired to study. In order to mix uniformly the small quantities of insoluble mineral matters with the charcoal, they were first triturated with a little charcoal, and then this mixture was added to the rest of the charcoal, stirring the whole in a capsule. The soluble substances were dissolved in 20 grammes of water, and the charcoal was impregnated with this solution. When 0·1 grammes of nitrate of ammonia was employed as a manure, 15 grammes of water were added, because the utility of this excess of water had been demonstrated by previous experiments. When

* *Journal für Praktische Chemie*, xlvi., 193.

no substance soluble in water was added to the charcoal, it was moistened with 20 grammes of water, after having introduced the insoluble substances. The seed was planted in the charcoal, prepared as we have just described, after having undergone the commencement of germination in perfectly pure charcoal.

The plants were watered with distilled water, and placed in the window of a room exposed to the sun, and of a southern aspect.

The mineral substances were, moreover, prepared with much care; their purity was previously tested. The silicates of potassa and soda were prepared by dissolving with heat uncalcined silica in a concentrated alkaline ley. Phosphate of lime was obtained by double decomposition with nitrate of lime and phosphate of ammonia. The oxide of iron was obtained by precipitating the nitrate of sesquioxide of iron by succinate of ammonia and calcining the precipitate so as to obtain a mixture of sesquioxide and protoxide.

We now briefly give the results of the experiments undertaken by the author:—

1. No mineral substances, and no nitrogenous matters; plant extremely slight, weighing only 0·05 grammes after desiccation.

2. No mineral substances; the charcoal was moistened with a solution of 0·04 grammes of carbonate of ammonia in 20 grammes of water; the same solution was employed for watering the vegetable during the experiment. Plant very slight. Leaves green and longer than in the foregoing experiment. The stem, 7½ inches high, bore a flower which did not fructify. The dried plant weighed 0·05 grammes.

3. No mineral substances: the charcoal was moistened with a solution of 0·1 gramme of carbonate of ammonia in 20 grammes of water. The plant died after shooting the first leaf. The solution of carbonate of ammonia was too concentrated.

4. No mineral substances: the charcoal was wetted with 20 grammes of water; then watered with a solution of 0·1 gramme of nitrate of ammonia in 20 grammes of water; 15 grammes of water was also added. The plant died after having put forth the second leaf. The roots were very short, and all turned towards the surface of the charcoal.

5. No ammoniacal matters. The following mineral matters were added to the charcoal:—

	Grammes.
Silica, Potassa } Silicate of Potassa	0·075, 0·030
Carbonate of lime	0·050
Phosphate of lime	0·040
Sulphate of lime	0·030
Carbonate of magnesia	0·020
Oxide of iron, containing manganese	0·020

The stalk, regularly formed, attained the length of 11 inches without any lateral stalks; the plant was very delicate, and bore three flowers, which aborted; the leaves were short, but green. The plant dried weighed 0·1 gramme.

6. Mineral substances and ammoniacal salts in the following proportions:—

	Grammes.
Silica, Potassa } Silicate of Potassa	0·075, 0·030
Carbonate of lime	0·500
Carbonate of magnesia	0·050
Phosphate of lime	0·100
Sulphate of lime	0.100
Nitrate of ammonia	0·050
Nitrate of lime	0·030

The stem, feeble and disposed to bend, grew to 25 inches, and bore five flowers and five in complete fruits. The joints were covered with sheaths.

The leaves were delicate and of a greenish yellow. The dried plant weighed 0·37 gramme.

7. No silica: mixture in the following proportions:—

	Grammes.
Nitrate of potassa dissolved in 20 grammes of water	0·044
Carbonate of lime	0·500
Carbonate of magnesia	0·250
Phosphate of lime	0·100
Sulphate of lime	0·100
Nitrate of ammonia, Nitrate of lime } Dissolved in 20 grammes of water	0·030, 0·030

In this experiment less carbonate of ammonia was used, in order to compensate by this diminution for the quantity of nitrogen contained in the nitre.

The plant grew to nine inches; it laid down, was very weak, and of a pale yellow color; the joints were enveloped by the sheaths of the leaves. A single flower was developed, which did not fructify. The dried plant weighed 0·37 gramme.

8. No potassa: mixture in the following proportions:—

	Grammes.
Hydrate of silica	1·0
Carbonate of lime	0·5
Carbonate of magnesia	0·05
Phosphate of lime	0·1
Sulphate of lime	0·1
Nitrate of ammonia, Nitrate of lime } Dissolved in 20 grammes of water.	0·05, 0·05

The plant died before the development of the second leaf; a second seed was planted. It was developed in a very feeble manner, and without bearing flowers; it attained the length of only 2½ inches; its roots were long and extremely thin.

9. No potassa: mineral matters in the following proportions:—

	Grammes.
Silica in jelly, suspended in 20 grammes of water	0·58
Carbonate of lime	0·50
Carbonate of magnesia	0·02
Phosphate of lime	0·04
Sulphate of lime	0·02
Nitrate of lime, dissolved in 20 grammes of water	0·03

Plant six inches long, very delicate, without flowers; roots long and thin.

10. No lime; mixture in the following proportions:—

		Grammes.
Silica, Potassa	Silicate of potassa dissolved in 20 grammes of water	0·078, 0·030
Carbonate of magnesia		0·070
Ammoniaco-magnesian phosphate		0·080
Nitrate of lime, Nitrate of ammonia	Dissolved in 20 grammes of water	0·020, 0·040

The plant died before the development of the second leaf. The roots were half an inch long, and turned upwards.

11. 0·5 grammes of carbonate of lime were added to the foregoing mixture, to see if the rapid perishing of the plant should be attributed to the absence of lime. In this new mixture the plant vegetated very well, as in experiment 6, although the color of the leaves was still very pale. Lime is, therefore, indispensable to the development of the plant.

12. No magnesia.

		Grammes.
Silica, Potassa	Silicate of potassa in 20 grammes of water	0·075, 0·030
Carbonate of lime		0·500
Phosphate of lime		0·100
Sulphate of lime		0·100
Nitrate of ammonia, Nitrate of lime	In 20 grms. of water.	0·050, 0·030

The plant attained the length of 13 inches, with a tendency to lie down; the first three leaves were very green, the following ones of a pale yellow. The dried plant weighed 0·32 gramme.

13. No phosphoric acid: the mineral matters as in No. 6, only suppressing the phosphate of lime.

The plant attained the length of 16 inches: the leaves were of a deep green, but short and narrow; the stalk delicate but regular.

Three flowers and a complete fruit; no lateral stalks; the dried plant weighed 0·17 gramme.

The phosphoric acid contained in the seed appears to have replaced that which the soil could not furnish; only the development of the plant suffered in consequence.

14. No sulphuric acid: the matters as in experiment 6, suppressing the sulphate of lime.

Plant 11 inches long: leaves of a deep green, but short and narrow, and not so well developed as in the preceding experiment.

Stalk normal, two flowers, no fruit; weight of the dried plant 0·12 gramme.

The sulphur contained in the seed was not sufficient for the development of the plant.

15. Without sulphuric or phosphoric acid: mineral matters as in experiment 6, without phosphate and sulphate of lime, and with a supplement of 0·05 of nitrate of ammonia. Plant, 16 inches long, leaves of a deep green, stem regular, one lateral stem, two flowers without fruits.

16. Silica, potassa, and ammonia, in the following proportions:—

Silica, Potassa	Silicate of potassa dissolved in 20 grammes of water	0·075, 0·030
Nitrate of ammonia dissolved in 20 grammes of water		0·080

The plant died during the development of the second leaf.

17. Hydrochlorate of ammonia 0·02 grammes; nitrate of ammonia, 0·04; the rest of the matters as in experiment 6.

Plant 9 inches long; weak; three flowers, without fruits; weight of the dried plant 0·24 grammes.

18. Neither lime nor magnesia, the rest of the matters in the following proportions:—

		Grammes.
Silica, Potassa	Silicate of potassa in 20 grammes of water	0·075, 0·030
Phosphate of lime		0·040
Sulphate of lime		0·030
Nitrate of ammonia in 20 grammes of water		0·010

Plant, 15 inches long; leaves, pale; stem, abnormal and weak.

Four flowers without fruit; weight of the dried plant, 0·21 gr. This experiment proves that the plant may flower without any magnesia in the soil, and that carbonate of lime may be replaced by other salts of lime.

19. Potassa and soda.

		Grammes.
Silica, Potassa, Soda	Alkaline silicate in 20 grammes of water	0·075, 0·020, 0·010
Carbonate of lime		0·050
Phosphate of lime		0·040
Sulphate of lime		0·030
Carbonate of magnesia		0·020
Nitrate of ammonia in 20 grammes of water		0·100

Plant, seven inches long; leaves, pale and of a greenish yellow; stem, abnormal; weight of the dried plant, 0·1.

20. Oxide of iron.

		Grammes.
Silica, Potassa	Silicate of potassa in 20 grammes of water	0·075 / 0·030
Carbonate of lime		0·050
Phosphate of lime		0·040
Sulphate of lime		0·030
Carbonate of magnesia		0·020
Black oxide of iron		0·100
Nitrate of ammonia in 20 grammes of water		0·100

The addition of oxide of iron caused a very active vegetation. The leaves of the plant were much more vigorous than in any of the foregoing experiments; they were 12 inches long, half an inch broad, rough, and of a deep green; only, after the development of the fourth leaf, dry spots of a greenish grey color were remarked in the middle of all the leaves.

Stem abnormal; joints covered with sheaths; plant 13 inches long; no flowers, but several lateral stalks. Weight of the dried plant, 0·4 gr. The proportion of iron was evidently too great.

21. Less iron.

Mineral matters in the same proportion as in the foregoing experiment, with the exception that only 0·010 grammes of oxide of iron was added. The plant was developed in a remarkable manner. Leaves green without dry spots; stem normal, and 24 inches long; joints rather weak; five flowers, but no fruits. Weight of the dry plant, 0·49 gr.

22. Soda and iron.

Mixed in the same proportion as in experiment 20, only one-third of the alkali was soda. Plant very tender; leaves green, with dry spots; no flowers.

23. Iron and manganese.

Mixed in the same proportion as in experiment 20, with the addition of 0·01 grs. of the carbonate of manganese.

Plant vigorous; leaves of a deep green, without dried spots. Joints stronger than in experiment 21, but partially enveloped in sheaths. The sheath of the last leaf was turned round spirally, an irregularity which appears to have arisen from an excess of manganese.

Length of the principal stem, 14 inches; several lateral stalks; no flowers. Weight of the dried plant, 1·09.

24. Iron and manganese.

		Grammes.
Silica, Potassa	Silicate of potash in 20 grammes of water	0·115 / 0·046
Carbonate of lime		0·500
Phosphate of lime		0·100
Sulphate of lime		0·030
Carbonate of magnesia		0·050
Oxide of iron		0·030
Carbonate of manganese		0·010
Nitrate of ammonia in 20 grammes of water		0·100

Plants extremely vigorous; leaves of a deep green; no dry spots; sheath of the last leaf less twisted than in the preceding experiment; last leaves of the lateral stalks normal.

Principal stem 26 inches long; joints strong and free from sheaths. Fifteen flowers without fruit, weight of the dried plant 1·29 grammes.

25. Manganese without iron.

Mixed in the proportion of experiment 20 without oxide of iron. Plant not very vigorous; leaves without spots, but pale; stem abnormal; 12 inches long; two tender flowers, without fruit, weight of the dried plant, 0·57 grammes.

26. Iron and manganese, without magnesia. Mixed as in the foregoing experiment: 0·1 gramme of oxide of iron was added. Stem and leaves less vigorous than in experiment 23; leaves of a deep green, without stains; stem abnormal. Length of the plant, 9 inches; no flower; one weak lateral stem. Weight of the dried plant, 0·36 grammes.

27. Iron, manganese, and soda, without potassa. In the foregoing mixture, 0·030 grammes of soda were substituted for the same quantity of potassa. Length of the stem, 15 inches; no flower; plant more tender than in experiment 23; the joints enveloped by sheaths. Leaves of a deep green, without stains; the last leaf was turned round several times on itself. Some weak lateral stalks were formed. Weight of the dried plant, 0·57 grammes.

28. The same mixture as in experiment 23; only the carbonate of manganese was not added until after the development of the fourth leaf, when stains began to appear. After this addition of carbonate of manganese the succeeding leaves were developed in a perfect manner; the stains were no longer exhibited, a result evidently due to the influence of manganese.

In this experiment, the stem, which was very tender, attained the length of 14 inches; it bore three flowers, but no fruit. The leaves were of a deep green; the sheath of the last leaf was not twisted. The author attributes this result to the limited action of the salt of manganese, which was applied only on the surface. The contrary effect, that is to say the twisting of the leaf, is produced by an excess of manganese.

29. Iron, manganese, potassa, and soda; mixed in the following proportions:—

		Grammes.
Silica, Potassa, Soda	Alkaline silicate in 20 grammes of water	0·10 / 0·03 / 0·01
Carbonate of lime		0·50

Phosphate of lime	0·04
Sulphate of lime	0·10
Carbonate of magnesia.....	0·04
Oxide of iron	0·03
Carbonate of manganese	0·01
Nitrate of ammonia in 20 grammes of water.....	0·10

Leaves, stem, and joints, very vigorous and normally developed. The leaves were of a deep green; the sheath of the last leaf was not at all twisted. The cause of this vigorous development may be attributed either to the proportions of the mixtures, somewhat modified, or to the simultaneous presence of potassa and soda. The author will endeavour to solve this question by new experiments.

In this last experiment the plant attained the length of 29 inches; it bore fourteen flowers without fruit; its lateral stems were formed. The weight of the dried plant was 1·46 gr.

The author, after having described his experiments, gives a series of conclusions, of which we subjoin a summary of the most important.

From the first experiments, it results that, for a plant to be developed, it must find in the soil at once nitrogenous matters and certain mineral substances. If these mineral matters consist only of silica, phosphoric and sulphuric acids combined with potassa, lime, and magnesia, the plant vegetates more actively than it would do in a soil entirely free from mineral matters; however, the vegetation is very feeble, even in presence of ammoniacal salts, and to afford it full vigor, it is sufficient to add to the foregoing mixture a certain quantity of oxide of iron. An excess of iron was injurious by partially drying the leaves and preventing the formation of the flowers. The carbonate of manganese, added in small quantities to the oxide of iron, produces very useful effects.

The utility of soda is not well demonstrated; however, it is certain that this alkali can be entirely substituted for potassa only to the detriment of the vegetation. In the same way magnesia cannot replace lime (Experiments 10 and 11).

Among the acids, sulphuric and nitric are necessary to the regular development of the plant (Experiments 13 and 14); silicic acid is indispensable.

To sum up, the fixed mineral matters absolutely necessary for the development of the vegetation of oats seem to be:—

Silica	Lime
Phosphoric acid	Magnesia
Sulphuric acid	Iron, and
Potassa	Manganese.

The author intends to determine, by further experiments, whether these mineral matters are likewise necessary and sufficient for the maturation of grains of oats, which almost constantly aborted in the foregoing experiments, perhaps on account of the season being far advanced. He purposes also to investigate the influence of chloride of sodium on the development of the plant.

ON THE ACTION OF OXIDE OF CARBON ON WEEVIL.*

BY M. BARRUEL.

The weevil of corn, peas, &c, in the state of perfect insects, were plunged into impure oxide of carbon gas, arising from the action of sulphuric acid on oxalic acid. They died instantaneously; at least they appeared dead from their being completely motionless; but as insects submitted to the action of this gas return to life in fresh air, when the contact with oxide of carbon has not lasted long enough, I maintained its action for a certain time; after 48 hours, on putting them in contact with the air, I found them perfectly dead.

Thinking that these same insects in the state of larva might present a difference in the impression which this gas might exert on them, I treated them in the same way; but the gas of this second experiment was mixed with a little air. Immobility was presented only after about 10 seconds. Some larvæ were, afterwards, added to the first, which permitted a portion of the gas to escape and give place to an equivalent volume of atmospheric air; they, however, became immovable in the same space of time. After 24 hours I put them in contact with the air; after two hours, those which had been last introduced into the flask returned to life; placed afterwards in the same circumstances as the first, they died.

It is, therefore, easy, from these experiments, to destroy the weevil in both these states by their contact, for a certain time, with oxide of carbon, even impure; I intend to determine the minimum time necessary for causing their absolute death. I am now occupied with this.

It was also important to determine whether or not the eggs of these insects resisted this action. To judge of this question, I took corn as healthy as possible, and I separated it into two parts; one was left in an open flask, with the corn containing the asphyxi-

* *Comptes Rendus.*

ated weevil; the other was mixed in the same way with another portion of corn containing asphyxiated weevil, but in a flask containing oxide of carbon. If weevil be developed in the first, and not in the second, the question will be decided.

From the results already obtained, I think that something useful has been done for the preservation of seeds which are rapidly destroyed by the enormous multiplication of these insects. It is not possible, for example, to transport habitually to the colonies barley in a natural state, but only in that of flour, which is heated and injured often, so as to be almost unfit for use after its passage through the tropics.

If any experiments which I have not thought of should appear to the Academy desirlabe, I shall be very happy to follow its suggestions.

COMPARATIVE EXPERIMENTS WITH GUANO AND OTHER MANURES.

BY R. S. BEAME.

I. This is a tabular report of an experiment made in Storr Park, Devon, to test the comparative efficacy of five different kinds of artificial manure in improving pond mud, the experiment being made on an acre of inferior pasture land, in the years 1847, 1848, and 1849. The land in which the experiment was conducted is of uniform quality, the soil being a light sandy loam, a few inches in depth, incumbent on a stratum of white clay. The land underwent thorough draining in 1844, prior to which it would not produce more than 5s. per acre. No manures were applied in 1848 and 1849. The object of extending the experiment over three years was to test the durability of the different manures.

No.	Manures Applied in 1847.	Weight of Hay cut in 1847.	Weight of Hay cut in 1848.	Weight of Hay cut in 1849.	Weight cut per Acre in 1847.	Weight cut per Acre in 1848.	Weight cut per Acre in 1849.	Cost of the Manures.
		lbs.	lbs.	lbs.	Seams of 3 cwt	Seams of 3 cwt	Seams of 3 cwt	*s. d.*
1	Six cubic yards of mud mixed with 6 cwt. of salt	312	327	613	4⅓	4¼	9	14 0
2	Six cubic yards of mud mixed with 1½ hogshead of lime..	358	337	538	5¼	5	8	13 6
3	Six cubic yards of mud mixed with 3 bushels of bone dust	511	419	670	7⅓	6¼	10	14 3
4	Three cubic yards of mud mixed with 3 cubic yards of tan-yard refuse.....	524	354	558	7¼	5¼	8⅓	14 0
5	Six cubic yards of mud mixed with 90 lbs. of Peruvian guano	930	550	725	13¼	8	10¼	14 0

II. Report of an experiment made with the undermentioned manures on an acre of pasture land in Storr Park, in 1849. The manures, when mixed with a small quantity of fine earth, were applied broadcast on March 29, and during the rainy weather which then prevailed. The land is of a fair average quality, and was formerly used as tillage land, but has been in pasture for many years. The crops were mowed on June 22, and the herbage produced by the different manures was of a superior quality.

No.	Manures applied.	Quantity of manure applied.	Quantity of manure applied.	Weight of Hay cut.	Weight cut per acre.	Cost of Manures.	Cost of the Manure per acre.
		cwt.		lbs.	Seams of 3 cwt.	£ s. d.	£ s. d.
1	None.....	..	..	401	4¼		
2	Superphosphate of lime.....	2½	9	616	7⅓	0 18 0	3 12 0
3	Nitrate of soda ..	1	4	706	8⅓	0 18 0	3 12 0
4	Peruvian guano ..	1½	6	1210	14⅓	0 18 0	3 12 0

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

SANITARY NOTES.

SANITARY Statistics have, for many years past, formed a portion of the labours of medical and other scientific men; and a vast amount of useful information of this description has been collected; insomuch, indeed, that, of many towns and districts of the kingdom, a map might be drawn out, with sanitary lines upon it, showing the varying health-conditions of the several parts, in the same manner that lines of altitude show the varying levels of the earth's surface. But if it be asked what works have been executed for the sanitary improvement of our thickset towns during the last 15 years, in which attention has been repeatedly drawn to the subject, there is but one fearful answer—scarcely anything.

That epidemic diseases vary in their intensity according to the degree of salubrity of the localities they visit, could never be doubted by intelligent observers; but the fact has been powerfully illustrated during the course of the present plague. It will be found, on examination, that in Berlin and Paris, which are but slightly altered from their condition in 1832, the cholera has not exceeded its former violence. In Hamburgh—a town which has undergone, since the great fire in 1842, a renovation almost equal to that of London after 1666—the visitation has been less severe than in 1832;—while in London, which has been allowed to extend to an unprecedented degree without sanitary regulations of any kind, and which may, therefore, be justly said to be in a worse condition than in 1832, the number of victims to the fearful scourge of cholera has, during the last ten weeks, exceeded the total number in the whole country, in an equal length of time, on the former occasion. Thirteen thousand victims have fallen under a disease, the violence of which is to a great extent attributable to our own neglect and carelessness. In other towns and places the disease has been equally fatal. The long line of docks at Liverpool, filled with stagnant water, and receiving the refuse of a thousand ships of every size and every country, has proved, in the recent peculiar state of the atmosphere, as fatal a neighbour to human life in crowded streets and cellars, as the tanks filled with putrid water under the wretched huts of the village of Mevagissey to the hardy labourers of the deep-sea fisheries.

There are two physical conditions under which all sanitary requisites may be classed, viz:—Ventilation and Cleanliness.

It is strange that a nation so sensitively alive as Englishmen are to any infringement of their civil rights, should passively submit to the most fearful encroachments on their physical rights; yet it is a fact that they have thought but lightly of the deprivation of that pure air which God has given them, and the substitution of a deadly poison, which destroys their health and consumes their powers. This evil, however, has reached a point at which human forbearance must cease, and when it has become a duty on every man to exert his utmost powers to counteract its effects and procure its abolition. It is time that Englishmen should take as much pride in repelling a secret and insidious enemy, that threatens their every home with sorrow, as in resistance to an open and visible one; it is time that more honour should be bestowed on those whose labour, health, and even life itself, has been given to save their fellow-beings from sickness, misery, and death, than on those whose profession exists by the destruction of life and happiness. There is not in the wide world a purer and more elevated chivalry than is exhibited in the labours of those who, in spite of danger the most deadly, and of scorn and insult the most disheartening, wage unflinching war upon the filth and misery of crowded populations, and exert the talents which a most beneficent Providence has bestowed upon them to procure for their fellow-thousands the requisites of health and happiness.

It would be premature to make compulsory regulations for the admission of air into the crowded dwellings of the poor, until that air is freed from the poisons which it holds in solution to a fearful amount. First

and foremost of the poison-stills of London and other large cities stand the burial-grounds and vaults. In the *Builder* of September 1st, the writer gives an account (with a drawing) of the Crypt of Bow Church, Cheapside, and adds:—"We can from our own knowledge speak of coffins in these London vaults bursting with a report like a pistol; and it is not unusual for the sexton to go round with a long iron spear, and puncture such coffins as he thinks suspicious." The Rector of Pentonville states that the sexton of his Church, on applying a candle to a crevice in a coffin in the vaults, produced a long jet of flame instantly. In the immediate neighbourhood of Bow Church, the cholera has been fatal to persons whose occupations brought them there for a few hours in the day, though their residences were in open, healthy parts of London. In the neighbourhood of Pentonville churchyard, and that of St. Andrew's, Holborn, which has ventilation holes pierced in the boundary wall, are houses which have never been free from fever during the last 10 years. These horrible details might be repeated and illustrated in many similar localities; suffice it now to refer to St. Clement Danes, St. Anne's Blackfriars, Portugal-street, Lambeth, Newington, Spa-fields, &c., all in London, each of which has its present horrors—its recent, and, as must be feared, its future victims.

Deleterious manufactures bear also a terrible part in the poisoning of that pure air which is man's right. From the lay-stalls of Battle-bridge, and the blood-boilers of Bow Common and Poplar, to the vast heaps of bones, half-covered with putrefying flesh which are deposited "for bone-crushing and manure making," amongst the crowded inhabitants of Lambeth, the presence of these poison-stills may be traced throughout London from the Registrar General's returns of deaths in the different localities. In Lambeth, for some weeks past, the inhabitants have been cut off at the rate of between 200 and 300 weekly.

In the presence of so formidable a destroyer as the cholera has proved, minor matters fall into the shade, and attention is forcibly drawn to the chief agents in deteriorating what, from the natural formation of the land, should be the pure air of London. There are here no natural causes for impure air; they are all of man's production. It is to be hoped that when the great Sorrow is past, the great Evils will not be forgotten.

House-ventilation, combining as it does with the extensive subject of cleanliness, cannot be entered on now.

A more important matter than this can hardly be found for the exercise of thought and talent. When we find that in London the ordinary average of deaths varies from 1 in 55 in one locality to 1 in 18 in another, —that in Liverpool it is about 1 in 25, while in other towns of Lancashire it is 1 in 42, surely we must infer that such enormous difference must be, partly at least, owing to causes which science may remove.

Medical men have long pointed out the localities and provocatives of disease; it is now more than time that the Legislator, the Architect, and Engineer should interfere to remove those causes, and that all parties should combine to improve the sanitary economy of their fellow-countrymen.

I. N. W.

ON PUBLIC HOSPITALS AS THEY ARE, AND AS THEY OUGHT TO BE, AS TO SITUATION, CONSTRUCTION, AND MANAGEMENT.

BY CHARLES WATT.

Too well are our readers and the public aware of the tardy, puerile, inefficient, and reluctant manner in which every improvement in the social condition of the community, and every advancement calculated to confer great and extensive benefit on mankind, are put into operation in this country —compared with their progress in every other—to render necessary any observation on this subject; and, therefore, little will it surprise them that hitherto no attention has been directed to, nor even notice taken of, the present situation, construction, and management of public hospitals. It is, however, matter of inexpressible astonishment that a subject of such vital importance should have escaped the observation of the many eminent men who, by their labors and distinguished talents, have contributed so greatly to the advancement of medical science.

That such men as Hunter, Baillie, Abernethy,* Gregory, Munro, and many others, should have overlooked that which so deeply involves the welfare of society is almost inconceivable. Such, however, is the fact, and it is left for me, in the 19th century, to call public attention to the evils, and their remedy, by the relation of a series of facts, and by the detail of practices almost too horrible and disgusting to obtain credence, or whose existence in a civilised community could be imagined.

* In his lectures he was accustomed to observe that accidents recovered and operations succeeded in the country, whilst they were often fatal in large towns.

In entering on this particular subject I am fully aware of the odium and obloquy which I am sure to incur from those whose interest it is to keep matters as they are, and rather to impede the progress of medical science than promote that which would tend to decrease their sources of gain, though it might be productive of the greatest benefit; and it is undoubtedly from some such cause that the public has so long been misled into a belief that our hospitals, being perfect and requiring no reformation or change, it is quite needless to bestow any attention on them, considering it utterly impossible that they can be improved.

With the view of proving, on the contrary, that they are now so far from what they ought to be as to compel me to express the greatest doubt whether they are a public benefit or a public injury, I lay before my readers as minute a statement of the circumstances and peculiarities of each as my space will admit of, and leave them to judge of the truth and merits of my observations.

In establishing a hospital for the recovery of the sick and diseased, surely the consideration of the first importance is the healthiness of the situation: it is of far greater value than any medicine or medical aid in all cases not purely surgical, and in many that are. Of what avail is medicine in the wards of a crowded hospital, situated amid a dense population, surrounded on all sides by smoke, and contaminated by the effluvia of decomposing vegetable and animal matters?

The reply is too plain.

When the older metropolitan hospitals were founded, there is every reason to believe that their positions, as to circumjacent evils, were very different from what they now are, and that they were free from the overwhelming nuisances with which they now abound; but, even if they were not, there is no reason, because they were established in places which are totally unfit, and have ever since continued so, that they should, in this enlightened age, be allowed to remain in them, objectionable as they are even for the habitations of the healthy. Whether they were so circumstanced on their first establishment, or whether nuisances and evils have since gathered around them, matters not; they do exist to so frightful an extent, that not to adopt a remedy without loss of time is, on the part of those who have the authority and power, a scandalous and unpardonable dereliction of duty, alike injurious to the healthy and to the sick.

The extent of the evil and the mischievous effects it entails on society are only to be justly appreciated by a brief review of the peculiarities of situation to which each hospital is exposed, and this it will be my object to give, resting fully satisfied that my labors in bringing before the public a subject of such grave and serious meditation will not be in vain.

It is my unalterable conviction that no public hospital ought to be situated where it is surrounded by houses; in short, it ought to be out of town, and not in it; first, because the air in such a locality is not congenial with the means used to restore health; and, secondly, because it is equally unfit that a number of persons afflicted with all kinds of diseases should be congregated among the habitations of those who are in health, and these dangerous and disgusting evils are the fate of all the inhabitants of London, from its centre to its circumference, as I shall now establish by individual detail, commencing with

ST. BARTHOLOMEW'S HOSPITAL,

which, if at the period of its institution it was surrounded by a tenth part of the nuisances and abominations which now exist, its location near Smithfield was quite worthy of the age of martyrdom and barbarity; but I strongly suspect that it was comparatively free from the number of pestilential contaminations with which it now, on all sides, abounds.

It is in the very centre of filth; on its north side it has Smithfield-market, with its disgusting scenes and collection of decomposing animal matter; a dense population of the most wretched and abject poor in Cow-cross, abounding in horse-slaughterers; Saffron and Mutton hills, and Long-lane, with their dirt and filth; on its western side it has Giltspur-street, Hosier-lane, Snow-hill, and that part of Field-lane through which runs the Fleet-ditch, *uncovered;* besides the crowded and poor population in the vicinity of Green Harbor-court, and the low precincts of the Old Bailey. On its south side it is even worse circumstanced, for, besides the air being greatly excluded by the high building of Christ's Hospital, with the volumes of smoke it pours down on it, there is Newgate-market, with its contiguous slaughter-houses, giving out, especially in hot weather, effluvia enough to contaminate the whole of London. On its eastern side, it is bounded by the crowded neighbourhood of Little Britain and Aldersgate-street, and subject to all the evils inseparable from such localities.

These are not, perhaps, the whole of the evils, but they are enough; and it has been stated lately that this hospital is more unhealthily placed than any similar establish-

ment in London, if it is possible, considering the account we have to give of

GUY'S AND ST. THOMAS'S HOSPITALS,

situate in the borough of Southwark. It is probable that when these were first founded the state of the neighbourhood was very different from what it now is, which is such as would induce us to believe that their founders were fit subjects for a commission of lunacy. They stand almost below ground, close to the banks of the Thames, at a part where all the sewers from the immense district of Bermondsey, Tooley-street, &c., pour forth their filth to decompose on the sides at low water, and diffuse their pestiferous vapors among the inhabitants; in addition to which they are surrounded by the Borough-market, with its never-ceasing animal and vegetable decompositions—by breweries, distilleries, &c., with their dense volumes of smoke—by the skin-market and by tan-yards, in the midst of a district abounding in the hovels of the abject poor, in courts from which air is quite excluded. I leave it to my readers to comment on such a site for two large hospitals, in which are hundreds of sick beds, mostly occupied, and now proceed to notice

THE LONDON HOSPITAL,

which, in consequence of the filth besetting it on every side has lately attracted the notice of the authorities, who seem, in their "zeal not according to knowledge" to have no idea that their establishment itself is a nuisance both physically and morally, of no common order, as I shall now prove to the fullest satisfaction and utter disgust of the community, and to the surprise, if not to the credit, of those by whom it is permitted to exist.

This receptacle for the sick is in the Whitechapel-road, and it has lately been proved that more than nine of the most offensive manufactories are carried on in its immediate vicinity—these are Patent Manure Companies, horse-slaughterers and boilers, soap-makers, distillers, sugar-refiners, &c. It has also the slaughter-houses in Whitechapel on one side, and Spitalfields market on the other; amidst a population of the very lowest kind, where poverty exists in its most frightful forms, and where from that and bad habits, consequent on ignorance and vice, cholera has made more than its usual havoc. It is merely necessary to state in conclusion, that it is in the immediate contiguity of Brick-lane and Wentworth-street, with their courts and alleys of abject and squalid misery and wretchedness, to give an idea of the position of this hospital.

And now I proceed to relate what concerns the hospital itself, which, with this one exception, is perhaps as well managed as any other; this exception is a violation of the best feelings of humanity, and even a profanation of a solemn religious rite. Its medical officers are equal to any in talent and humanity, and some are authors of works I have often reviewed with great pleasure and satisfaction, yet have they by some oversight, or by extreme occupation, allowed the following loathsome, barberous, and dangerous piece of mockery to exist in the face of every passenger, and even of the poor afflicted inmates.

It is well known that by the Anatomy Act, obtained by Mr. Warburton, the bodies of persons dying in hospitals and poor-houses, and not claimed by friends, are given for dissection, and the remains are afterwards put into coffins and buried with the curtailed rites usually performed over the poor. In observance of this regulation, the authorities of the London Hospital have chosen a place at the rear of the institution, and quite within the sight of the patients; whether this ground is consecrated or not is of more importance to the Bishop of London than to us, or as viewed in connection with the facts I am about to record.

In this piece of ground is dug a large hole, and when as many bodies have been dissected as will fill coffins sufficient to lay within two or three feet of the surface, a clergyman comes at about nine o'clock in the morning—somewhat ashamed, doubtless, to meet the numbers which at a later hour might congregate—and performs the ceremony; but whether he is committing "dear brothers or sisters," or a due admixture of both "to the ground," I leave to those who have the job of making up these packing-cases of human flesh.

So vile an abomination, and so flagrant an outrage on the best feelings of human nature, would be a disgrace to any country but one degree removed from barbarism; and is made the more revolting by being committed under the very eyes of those who are doomed, in addition to their own afflictions, which need no increase, to witness the lowering into the earth of the flesh, after being dissected, probably of those who occupied the next beds of death, and who must soon follow their mangled fellow-sufferers, now for ever hidden from human sight, and with whom, while writhing in agony or sinking in deliquium, they have often exchanged those "pious drops the closing eye requires," and are doomed to endure the sight of the horrid atrocity in the silence of terror and abhorrence.

Gladly do we pass from these frightful details to the peculiarities as to situations of

THE SMALL-POX AND FEVER HOSPITALS.

These seem, indeed, to have been chosen, as it were, to propagate and not to cure those diseases; they are most delusive abortions; their locality and internal constructions are equally in harmony. They are placed in the low swamps of King's-cross, near the stagnant basin of the canal, surrounded on all sides by horse-slaughterers and boilers, varnish-makers, dust-yards, and other nuisances; the latter has, of late, been doomed to removal to Islington, leaving the former in sole possession of the benefits it so long enjoyed, and carrying its not very congenial or desirable influence to its new locality. The change is, however, on the whole, for the better, yet does it evince so partial and trivial an improvement as to display gross ignorance as to the real object; but I will leave it to make my observations on

THE MIDDLESEX HOSPITAL.

This is situated at the northern extremity of Berners-street, and has, certainly, less nuisances than those already made the subject of remark; yet its position is by no means suited for a house intended for the cure of the sick, and to show the utter want of knowledge and perfect disregard as to a proper selection of a spot, a new and capacious wing has lately been added; but this sinks into perfect insignificance when compared with the site chosen for the new

KING'S COLLEGE HOSPITAL,

now about to be erected in the neighborhood of Portugal-street, Lincoln's-inn-fields. This hospital will, like its temporary building, be in the midst of the crowded vicinity of St. Clement's, with Clare-market and the close and confined courts, redolent of filth and stench, in its immediate proximity and actual contact. Looking into the churchyard, now ordered to be closed, which is conspicuous for the disgusting scenes which have been disclosed within it, as well as for being the resting-place of the original Joe Miller, who, if alive, would certainly jest at such a selection for the foundation of an hospital, but, at present, we must merely notice it, and proceed to give a brief account of

UNIVERSITY COLLEGE HOSPITAL,

at the north end of Gower-street. The situation of this institution is not such as to call for any further remarks, than that, as a general principle, no such establishment ought to be in a large and crowded locality; we, therefore, proceed to notice

ST. GEORGE'S HOSPITAL, AT HYDE-PARK-CORNER.

which, although not badly situated as regards the institution itself, and the health of its inmates, ought not to be within two or three miles of its site. It is difficult to conceive how any rational being could have selected such a spot as that chosen for

CHARING-CROSS HOSPITAL.

It is surrounded by many objectionable evils: the neighborhood is dense and crowded; houses surround it in every direction, consequently it must be far from healthy, and must be uncongenial to the recovery of the sick.

I now come to

THE NEW HOSPITAL FOR CONSUMPTION AT BROMPTON.

It is said that this is the healthiest situation in London. Be it so. I ask, is it the most healthy place that can be found *out* of it? and there, alone, should a hospital, especially for such a complaint as tubercular phthysis, be erected? I greatly fear that all who go in with real consumption are carried out by the undertaker. Medical aid, without the best air, is a perfect farce, and with it, I fear, very little to be relied on. Some physicians, thinking to acquire notoriety by getting a number of subscribers and establishing such an Institution, may find it a sure and speedy way of obtaining practice. A carriage seen rolling down every morning naturally creates enquiry as to who are the medical attendants, and what the wonder-working results of their skill? Certain, however, it is, that it is much more likely to prove a source of benefit to the physician than to the patients.

For my own part, I am satisfied that it would be far more advantageously located in the country, and, although it would be further from physic, it would receive an immeasurably more valuable remedial agent—pure air; and arrangements as to the former are easily practicable, as I shall prove when I present my readers and the public with the result of my attention to, and reflections on the subject of hospitals during a long course of years. I shall, therefore, give but one more brief sketch, that of

THE FREE HOSPITAL IN THE GRAY'S-INN-ROAD.

This, without doubt, is one of the most benevolent and philanthropical institutions in the metropolis. It receives, without any letter of authority, the poor who are the subjects of any disease—poverty and sickness are the only recommendations necessary for admission. So far I have no inclination,

nor does it become my duty, to offer any animadversions. Inasmuch as it is immediately accessible to the sick it is valuable, but, so far as it partakes of the nature of a general public hospital, having beds and wards for persons laboring under constitutional and chronic disease, it is, like them, subject to all the objections with which they abound. Its value, however, as an asylum to which the poor and afflicted can at once gain admission, is too evident to render it an object of strict criticism.

Enough, I am convinced, has now been advanced as to the situations of our metropolitan hospitals, to convince their most ardent admirers, while continued in their present localities, of their total unfitness for the benevolent purposes for which they were founded; and I am certain that, from this cause alone, much of the good which they are intended to produce is prevented. They are placed in their different localities on the notion that physic and medical aid are all-important and primary objects, and pure air secondary to what those who founded them considered as within the power of the professors of the healing art. This is a fatal mistake, and one which I shall show greatly frustrates the intentions for which they were established, and in the end is the cause of a far greater amount of expenditure than would be necessary if the uncostly and powerful aid of country air were made to supply the place of physic, and substituted for the foul contaminations which everywhere surround them. In the cases of the wealthy, are not medical men aware of the greater benefit to be obtained from good air than from all the medicine and advice they can suggest or afford, and do they not recommend it? Why then cannot hospitals have this great advantage, this invaluable auxiliary? I reply, there is no substantial reason. The difficulty which will, doubtless, be urged in the case of the sick in hospitals is one more in theory than practice—in imagination more than in reality. We too often anticipate or take for granted that difficulties exist, and give ourselves no trouble to investigate the truth, or to view the subject thoroughly in all its bearings, with that determination and care which all great and important matters demand; and surely, one that concerns the public so much as health, the most invaluable of human blessings, must be deemed of the first magnitude, as that which alike concerns and affects us all.

What the difficulties to the change of location to more healthy places are, and the means by which they are to be overcome, will be fully stated in our next number; but before I conclude this part of my subject, I may ask are there no other reasons why public hospitals should not be placed in crowded towns or cities than what relates to the patients themselves? I reply that there are, and among the most conspicuous may first be stated the concentrating and collecting into each of them diseases of all kinds—contagious and infectious, loathsome and obnoxious—and thus bringing among the inhabitants, as I have already shown, in the most crowded and populous situations, a source from which those evils may be diffused and propagated in their vicinity to quite as great an extent as they are cured within them. It is more than probable that this fact has been passed over by those who are intrusted with the management of these Institutions, and for what they care, would ever remain unnoticed. It is, however, a matter which concerns a higher power—the public—and to this quarter alone must we look for that attention to it which its importance demands.

There is also another serious evil engendered by their situation in populous districts; the schools attached to them are nuisances of sufficient magnitude to demand serious consideration. The dissection of the dead in the same building in which are the sick is a scandalous and revolting practice, and one greatly tending to bring them into disrepute; as is evident from the long-conceived notion and prejudice that the inmates are first made the subjects of all sorts of experiments, and after death are dissected "nolens volens" as regards their friends.

Facts such as the preceding (and deny them who can) are, doubtless, sufficient to convince the public mind that, both as regards the welfare of the patients, as well as of the community, hospitals are now in the very places, of all others, least suited to, or consistent with, the objects for which they are designed—the good of all, by giving relief to the afflicted, and by aiding the advancement of a profession, if equalled by any, surpassed by none in value and importance.

In my next I shall resume the subject in relation to the Construction and Management of these Institutions, and detail the means by which the evils and defects in which they at present abound may be removed with facility, benefit, and economy alike to the poor, the managers, and society.

(*To be continued.*)

ON THE STARCHES OF COMMERCE.

BY DR. INMAN.

The following is the substance of a lecture delivered by Dr. Inman before the Liverpool Chemists' Association, at the Royal Institu-

tion, Colquitt-street, on the 3rd of August, 1849:—

The word *starch* is a generic one, although usually restricted in commerce to one variety.

All amylaceous substances are essentially the same in their chemical characters, and in their effect on the animal economy, and the points of difference between any two are comparatively trifling.

Starch is a vegetable product, never being found in the animal kingdom, except when introduced from without. This observation had served Meyen, Ralfs, and others, with a means of distinguishing between animal and vegetable life; and had reduced many so-called animalculæ to the lowest order of confervæ, desmidiæ, &c.

He then reverted to the organs in which starch is usually found, and pointed out that its use in the vegetable kingdom is to provide nourishment for young shoots or branches before they are able to procure it direct from the soil. It exists also in many parts where active changes are taking place; in the stomata of leaves, for example, at the base of the petiole, and in adjoining bark prior to the fall of the leaf. The coloring matter of leaves is a modification of starch.

He then spoke of its chemical characteristics. It is colored blue by iodine, both cold and hot, is insoluble in cold, and apparently soluble in hot, water. This solution is not a true one, for he had, under very favorable circumstances, succeeded in procuring the starch again after it had been subjected to boiling for some time. To succeed in this experiment a great amount of dilution is necessary. The so-called solution, at first thick and glutinous, becomes, after a while, watery and thin; after standing some time the solution precipitates, leaving a clear, supernatant liquor. This being tested by iodine showed the existence of a very minute quantity of really dissolved starch.

Although insoluble in hot water alone, the addition of urine, and of some neutral salts, enables the greater part of the starch to be taken up—a small precipitant is left, consisting of the remains of the granules unacted on by either. This is why urine is so much used in those processes of dyeing where starchy substances are employed to make the stuffs take the colors better.

In its chemical composition, starch is closely allied to sugar, into which it is readily converted by the action of saliva in animals, and by germination or growth in vegetables.

When examined by the microscope, starch is found to consist of granules of various sizes. Each granule has a point called the *hilum*, round which are marked a number of irregularly concentric ellipses or circles.

The size of the granule, the position of the *hilum*, and the distinctness of the concentric lines, vary in different species of plants.

After describing the characters of many of the principal farinas, or starches of commerce, he observed that they might be divided into two classes, those with small granules and those with large. In the former he placed the different arrow-roots—sago, rice, barley, Indian meal, millet, and a variety of others; in the latter, the potato and wheat starches, and the *tous-les-mois*. Any adulteration of arrow-root with the farinas of the second class he considered could be at once detected by the microscope; but he doubted if that instrument could throw any light upon its adulteration by sago, rice, or other farina with small granules.

There has been much discussion as to the true nature of the granules of starch, some contending that they are developed in a membrane; and others, that there is no distinct capsule. After a careful consideration of the subject, he had come to the conclusion that there was some truth in both theories. There are two distinct substances in each grain, one which is readily acted on by water, the other which is not. In most cases the latter forms an outside coating, and looks membraniform; but in some, as the wheat and sago for example, the denser portion appears to have a different arrangement, and may be seen as a ring, a coil, or as divergent rays.

Double granules are occasionally found, which are accounted for by supposing two nuclei to be in opposition at one of their margins, and becoming united by additional layers.

He then drew attention to solutions of different forms of farina, all of which were of the same relative proportion with regard to the weight of starch and water employed. It appeared that potato-starch made the thickest solution, but became thin the most rapidly; that no essential difference could be detected between the Bermuda arrow-root, the Tahiti, the St. Vincent, the *tous-les-mois*, and the tapioca. All the other starches were very thin and watery.

He then adverted to the value of starch as food, noticed the difficulty of its digestion when taken cold and uncooked, and its ready dissolution in the stomach when taken after boiling, proving the influence of torrefaction in rendering grains more digestible, and thus explained the superiority of baked over raw flour in preparing infant's food.

There are differences to be detected in the digestibility of the various farinas. Potato-starch is usually considered to produce flatu-

lence and a disposition to diarrhœa, while arrow-root is considered to induce a tendency to constipation. On the whole, tapioca appears the best food for infants. No decided rule could, however, be laid down with respect to this, as each stomach appears to have an idiosyncracy of its own.

After a few words on the preparation of starch, and the necessity there was for its being always thoroughly washed from any adhering vegetable matter, he concluded by observing, that he considered all the arrow-roots, the *tous-les-mois*, and the tapioca, of equal value as dietetics; that the difference in their price was by no means a criterion of their respective goodness, and he would recommend those whose means were limited to purchase a larger quantity of low-priced arrow-root (say St. Vincent or South Sea), rather than a smaller of the best Bermuda.

Dr. Inman then exhibited a number of starches under his powerful microscope.

COMPOSITION OF A CALCULUS FROM A MONKEY'S LIVER.*

BY THORNTON J. HERAPATH, ESQ.

The animal which formed the subject of this observation was a favorite male monkey, lately in the possession of my friend, Charles T. Coathupe, Esq., of Wraxall House, near Bristol. It having died suddenly, after a short illness, a *post mortem* examination of the body was instituted by Mr. Coathupe, when, amongst other morbid appearances, it was found that the two principal lobes of the liver had been connected together, and at the point of junction a cyst had been formed, which contained a small calculus of an elongated oval form. This calculus, when first extracted, was soft to the touch, but it speedily became hard upon drying. It weighed about half a grain, and consisted of a white pulpy substance, enclosed in a somewhat fibrous or membranous external covering. When dry, the white interior portion, which was perfectly amorphous, and exhibited not the slightest traces of a crystalline structure, was easily removed by the point of a penknife, from the hardened epidermis, and was then found to contain the following properties:—Heated to redness upon platina foil, it turned black, and afterwards burnt with a smoky flame, exhaling the odor of burnt horn of feather. The white ash which remained behind was almost entirely soluble in diluted nitric and hydrochloric acids, with considerable effervescence, and the acid solution yielded, upon the addition of an excess of ammonia, a white bulky precipitate, which was completely dissolved by acetic acid. Oxalate of ammonia and phosphate of soda furnished the usual indication of lime and magnesia.

Boiling alcohol and ether extracted a small quantity of fat from the original calculus, and water afterwards removed a trace of chloride of sodium. Acted upon by diluted hydrochloric acid, the earthy salts, which formed about half the entire weight of the calculus, were extracted, leaving a bulky residue of albumen. This, when treated with strong nitric acid, was turned of a yellow color, which behaviour would appear to point out the presence of fibrine.

Its quantitative analysis was as follows, but the calculus was of too small a size to enable me to determine its composition with any great degree of accuracy:—

Water	A little.
Albumen, with a little fibrine and fatty matter	0·178
Phosphate of lime, with traces of phosphate of magnesia ...	0·094
Perphosphate of iron	Exceedingly minute traces.
Carbonate of lime, with some carbonate of magnesia	0·068
Chloride of sodium	Traces.
Epidermis and loss	0·160
	0·500

Mansion House, Old Park, Bristol,
August 26th, 1849.

* *Chemical Gazette*, Sept. 15, 1849.

ON THE DISINFECTION OF THE DEAD.

BY CHARLES WATT.

Much has been written, and still more has been talked, about the dangerous and disgusting system of intramural interment, and the existence of grave-yards in the midst of the habitations of the living. Indeed, to such an extent is this unpardonable outrage on all feeling and decency, both to the living and the dead, carried in certain towns, and particularly in Manchester, that we are acquainted with a gentleman who, until very lately, was obliged to walk over the stone slab covering the grave of his father. This, however, is not the only nuisance permitted in church-yards. In the same town we have often witnessed, at the burying-ground of the Roman Catholic Church of St. Augustine, in the London-road, the following most dangerous and revolting manner of depositing the dead:—A large hole is dug, and when filled, and containing some twenty or more coffins, piled to within two or three feet of

the surface, they are then covered with earth; they are often suffered to remain for days, and the odor, especially in hot weather, is past description. Such a practice is highly reprehensible and deleterious: the more so as the death of those deposited is often the result of fevers and other infectious diseases, and no steps are taken to prevent this sad nuisance, for, to our knowledge, it has existed ten years.

Is there any prospect of a remedy? Does the Government adopt any measures for its suppression? The reply is, that it is left totally unnoticed. Mr. G. A. Walker labors; he calls meetings and addresses them, and others bear testimony to the evils, and relate facts absolutely sickening and horrible, but what does the public gain by their efforts? "Vox et præterea nihil!" and no other result will be obtained until the public itself compels the subject to be made matter of attention.

In this place it is not our intention to enter into any details; a sufficient number of facts has been accumulated from various quarters to call for an enactment of the Legislature to enforce the suppression of this injurious custom. While, however, this evil exists, and even where it is removed, there is one plan which we deem it right to suggest, and which many years ago, when in practice, we adopted with very good effects, and which ought to be universally followed. When the undertaker is about to put the body into a shell or coffin, let him put at the bottom, among the sawdust, a few ounces of chloride of lime; this will decompose the noxious gases issuing out, and combine with the hydrogen, and thus they will be quite harmless. By this method the place in which the body is kept before interment will be inoffensive to the inmates and to the men who bear it to the grave, often to their own risk, or, at least, with great suffering, from the direful effluvia emitted.

In all cases of cholera this practice ought to be observed; for the evidences of its infectious nature are by far greater than those against it, and in such cases, as the subtle matter will be acted upon by chlorine, it is highly beneficial to employ it, without any regard to the supposed atmospheric or electric cause of its origin as an epidemic. By the plan here proposed much of the danger of the present mode of interment would be obviated, and at this period it is everywhere demanded; and even when the pestilence has passed over, it will be of great benefit, and to those who are compelled to come in close contact with the dead a safeguard and protection.

We fear the Board of Health is a perfect failure, for all expectations have ended in sad disappointment. They have met and talked day after day, but no single efficient act of improvement in the sanitary state have they performed. All the light they possess they keep within them; none is radiated; their wisdom is "born to blush unseen," and "waste its" lustre "on the desert air." Their office affords them ample opportunities of effecting much, and much would have been done, were they penetrating and observing enough to discern the proper objects to be attained, and able to carry them into execution so as to improve the healthy state of the metropolis.

ON THE PREPARATION OF CROTON OIL.

BY M. DOMINE.

Croton oil is a product which most pharmacians purchase, since its preparation is regarded as dangerous. However, it is desirable that all apothecaries should be able to prepare it themselves; for it frequently happens that oil coming from the best houses in Paris does not contain all the active properties which the physician has a right to expect. It appeared to me very useful to discover the means of supplying a product as active as simple in its preparation; such is the result which I now have the honor of communicating to the Société de Pharmacie, and I shall be happy if my efforts be regarded of some utility.

The ordinary process consists, as is known, in crushing the seeds, pressing them powerfully in a *cerital* cloth, separating the product, then exposing the residue to the action of alcohol rectified with the aid of a temperature of from 122° to 140° F.; pressing again, distilling the alcoholic product, collecting the oil, and mixing the two products thus obtained after filtration.

An examination of the composition of croton seeds shows that this process may be considerably modified. Indeed, these seeds consist of crotonic acid, which is very volatile, of brownish oil, resin, a brownish matter, of crotonine,* a white fatty matter, albumen, gum, and a glutinous matter.

The ordinary process is attended with danger on account of the presence of crotonic acid, and of its easy reproduction; of the long contact of the operator with the seeds; hence the fear felt by many pharmaceutists, and the necessity of almost exclusively buying this oil.

* The existence of crotonine is denied by Wilpen.

On account of the volatility of the active principles of this oil, I was led to believe that it was not adulterated because often found perfectly innocuous. It is, therefore, especially to a different mode of preparation that I have directed my attention.

The composition of croton seeds scarcely pointed to the employment of ether. This agent is, indeed, capable of dissolving the crotonic acid, the crotonine, and the brownish matter, without attacking the albuminous and gummy substances.

I prepared the oil at first in this manner: the seeds were bruised and introduced into Robiquet's displacement apparatus. I obtained only 18 per cent. of a very slightly colored oil. But this oil, submitted to a medical experiment, produced little or no rubefaction. I modified the solvent, hoping by this mode to succeed.

I was, moreover, very naturally led to it by the doubtless more complete solubility of the active principles of croton in a mixture of ether and alcohol. I made a mixture in such proportions that it would be easy for me (as it was essential) to separate spontaneously the oil from the solvent entirely and without heat.

I at once adopted and kept, as I indicate, an alcoholic ether, containing 25 per cent. of alcohol, at 45°. This mixture uniformly gave me the same result, and always a product of similar intensity. It appears to me useless to enter into all the operative details of my various experiments. I will narrate a single one, which will serve as a *modus faciendi*.

Grind commercial croton seeds in a mill so as to reduce them to a coarse powder. Immediately clean the mill with fine sawdust or bran. Introduce a little cotton at the lower extremity of the funnel, and throw in, stirring moderately with a wooden pestle or other round polished body, the prepared croton powder, cover the powder introduced into the funnel with a layer of cotton well stretched, so as to perfectly divide the dissolving liquid.

Then pour in by small portions the alcoholic ether until the quantity added amounts to twice the weight of the croton powder. Receive the liquid, which is at first very thick, becomes more and more fluid, into a porcelain capsule. The product which drops from the funnel may be divided; the first portion is pure oil; it contains more alcoholic ether as the fluidity increases. In all cases, when this product is obtained, leave it for a few days in the open air, in order to allow all the ether time to evaporate spontaneously. As to the alcohol which the liquid retains, it may easily be separated by introducing it into a funnel closed at the lower end, to which the alcohol subsides. There then remains only to filter the product obtained. Croton oil is certainly very easy to prepare in this manner; it is always alike, and is prepared promptly and without any other precaution than not to touch it with the fingers. Its color is deeper than that which I obtained with ether alone, owing to the dissolving of the body which did not color the ethereal oil; it has the advantage over the latter of not obstinately depositing the white fatty matter, a kind of stearine which the ethereal oil contains in considerable quantity. A small proportion of gelatinous matter separates when the liquid is evaporated, when the filtered oil, free from alcohol, remains perfectly limpid. It possesses in the highest degree the erysipelatous rubefacient action which the physician often vainly looks for in the croton oil of commerce. This process has, moreover, the advantage of furnishing a larger produce than the complex mode in common use. I obtained on an average, in my experiments, from 100 parts of seed freed from stalks and decayed seeds, 50 parts of pure croton oil with ether containing 25 per cent. of alcohol. As to the rough bruised seeds the proportion always varied between 26 and 32 per cent.

By shaking very briskly the coarse powder in an apparatus which contained 100 grammes (1 gramme=15·434 grammes) of crude seeds, coarsely bruised, I obtained 25 grammes of very beautiful filtered oil, which represents 350 grammes per kilogramme (rather more than 2lb.—lbs. $2\frac{1}{2}$), whilst by the complex process Soubrivar obtained only 270 grammes. The advantages of a process easy to follow, will, I hope, be to all pharmaceutical chemists, who are lovers of their art, an inducement for preparing, themselves, a product whose action is very often waited for like that of mustard, laudanum, &c.

At the commencement of my experiments, I was of opinion that the want of activity of the oil is often due to the different appearance of the seeds. Imbued with this idea, I carefully crushed, one after another, seeds of croton for comparative experiments. But I was forced to form a different opinion, for these grains are of a very remarkably similar composition. They always yield from 48 to 50 per 100 of crushed seeds, from which the oil was to be extracted; 10 to 12 per cent. of doubtful or mouldy seeds, furnishing also a very small quantity of a deeper colored oil; the remainder composes the shells. The oil prepared having nothing to gain from the exclusion or the presence of doubtful seeds, I think it useful to preserve the seeds as they are found.

The value of the above process appears to me to reside entirely in the absolute subtraction of the employment of heat, the uniform composition of the solvent to be employed, and the uniform simplicity of the operative method.

CITRATE OF IRON MODIFIED BY AMMONIA.*

BY M. J. B. DEPAIRE.

Since M. Beral proposed the medicinal employment of citrate of iron, this salt has undergone various modifications in its preparation—some to render it more agreeable to the taste, others more assimilable by the organs which it ought to influence. It was in these directions principally that citrate of ammonia and iron was proposed by MM. Beral and Haidlen. The assimilation may be gained by the adjunction of citrate of ammonia; as to its taste, I cannot, try what I will, find any improvement in it. I observe, on the contrary, in the citrate of iron and ammonia a disagreeable bitter taste, which the citrate of iron does not possess.

In his memoir on ferruginous preparations, M. Mialhe states that the citrate of peroxide of iron is a good preparation, of a very powerful taste, but that it is sufficient to add to it a small quantity of soda or ammonia to make it lose most of its taste. This observation is perfectly correct. The citrate of iron, to which ammonia is added, acquired such organoliptic properties that one would be tempted to take it for another compound, if analysis did not recognise in it the same elements in the same proportions, combined with a small quantity of ammonia.

When liquid ammonia is poured on dry citrate of iron the mass becomes heated, the salt agglomerates at first, and afterwards dissolves into a deep red liquid. If this solution be evaporated at a gentle heat, and if it be laid in thin layers on capsules, or sheets of glass, the greater part of the ammonia volatilises, leaving, as a residue, scales of a fine pomegranate red. This salt, which I will designate by the name of *citrate of iron modified by ammonia*, in order to distinguish it from the ammonio-citrate of iron, which is quite different, is deliquescent, soluble in all proportions in cold water, insoluble in strong alcohol, which precipitates it in part from its concentrated alcoholic solution, almost tasteless compared with citrate of iron or ammonio-citrate of iron, forming with water a red solution, whilst that of the citrate of iron and ammonia is greenish yellow.

* *Journal de Pharmacie d'Anvers.*

The following proportions appeared to me proper for preparing this salt:—

1. Neutral citrate of iron, in scales .. 2
   Cold distilled water 2
   Liquid ammonia 1

Mix, allow the salt to dissolve, pour the solution into plates, and dry at a gentle heat. Remove the product in scales, and keep it in well-stoppered bottles.

2. Concentrated solution of citrate of iron obtained by the saturation of citric-acid with hydrated peroxide of iron..... 3 R.V.

Liquid ammonia in sufficient quantity for the mixture to smell strongly of it. Operate as before.

The citrate of iron modified by ammonia has a taste so much the more agreeable, as the citrate of iron used for preparing it is well saturated with oxide of iron. Its composition varies as to the quantity of ammonia, according to the state of the saturation of the primitive citrate; and it is known that it is difficult to saturate citric acid, completely, with oxide of iron. When we operate on a very neutral citrate, the quantity of the modified product obtained scarcely exceeds the weight of the citrate employed. During desiccation ammonia constantly volatilises, and even when the product is dry, it also exhales the odor of the volatile alkali. When heated in the air at a temperature below that of the decomposition of the citrate, it loses all its ammonia without melting or swelling up, and there remain scales of a lead black, insoluble in water.

If, as M. Mialhe asserts, the small portion of ammonia united with the citrate of iron does not improve its medicinal qualities, I think that citrate of iron modified by ammonia might be prescribed with advantage in cases in which ferruginous preparations are indicated, especially in subjects who have a repugnance for this kind of medicine.

The syrup prepared with—

	Grms.	Grns.
Citrate of iron modified with ammonia	16	247
Cinnamon-water	10	247
Simple Syrup	500	7717

is one of the pharmaceutical preparations most agreeable to the taste. The liquid form appears to be preferable for the administration of this remedy; but care must be taken to avoid the association of acid substances, which, re-acting on the ammonia contained in the iron salt, might restore to it its original taste, and communicate to the mixture the saline, and sometimes bitter, taste of the ammoniacal salts.

ON THE VISCID PERSPIRATION OF CHOLERA PATIENTS.*

BY M. DOYÉRE.

M. Doyére found that, in four cases of cholera, the viscid perspiration collected on the forehead, the cheeks, the arms, contained a substance capable of reducing the compounds of copper in the same manner as the sugar of fruits.

Is this matter sugar? This will be shown by more decisive experiments, to which M. Doyére calls the attention of observers. At Paris, as the cases are becoming more rare, these investigations will be more difficult.

The non-viscid perspiration, the serum of the blood, the urine and stools, produced no reduction.

The liquid vomited by a patient, who had taken only Seltzer water, furnished a very abundant precipitate.

The viscid perspiration was collected with cotton moistened with distilled water, with which the places on which was the viscid perspiration were washed.

METHOD OF TESTING OPIUM.

BY M. A. GUILLIERMOND, OF LYONS.

The process hitherto used for testing opiums being very long and complicated, M. Guilliermond proposes the following in place of it:—

Take 15 grammes of the opium to be tested. After having cut it in pieces, mix it in a mortar with 60 grammes of alcohol at 160° F., and strain it through linen, to separate the tincture; press out the residue, and operate on it with 40 grammes of fresh alcohol at the same degree; mix the tinctures in a wide-mouthed bottle, in which are four grammes of ammonia. Twelve hours after, the morphine will be spontaneously eliminated, accompanied by more or less narcotine—the morphine covering the interior of the vessel with colored crystals, large, and feeling like sand; the narcotine crystallising in very light, small, white and pearly needles. Wash these crystals with water, either through a filter or linen, to free them from the micosate of ammonia which they contain. After this the narcotine may be separated from the morphine by decantation in water, which will only remove the lightest part of the narcotine.

M. Mialhe has modified this plan of separation, and prefers washing five or six times with four or five grammes of ether. This washing, performed by triturating the already pulverised crystals, leaves the morphine, which must then be dried and weighed.

* *Comptes Rendu*, No. 8, Aug. 20,1849.

COLLODIUM CANTHARIDALE.*

BY M. J. ILISCH, OF ST. PETERSBURG.

According to M. Ilisch, collodium combined with cantharidine can be employed with great success as an epispastic remedy; not only can it take the place of ordinary cantharides plaster, but it offers this advantage, that by its use we can do without the linen or leather necessary for the application of the latter. This epispastic collodium is recommended especially when it is wished to put a powerful blister on a part of the body where it is liable to be easily displaced by the movements of the patient, or when his irritability is opposed to the blister retaining its position, which would destroy its action, or, at least, put it on some other part of the body.

To employ the cantharidal collodium, it is sufficient to spread it with a camel's hair brush on the place where the blister is required. If, when the collodium dries, which will take place in less than a minute, the skin is not entirely covered, the same operation is repeated. A more rapid and more certain action will be obtained if the part spread with collodium is covered with a little lard or simple cerate. The cantharidal collodium requires no more time to produce its effect than an ordinary blister; however, it has this advantage, the movements of the patient in no way prevent its acting.

Preparation—Exhaust, by the method of displacement, one pound of coarsely pulverised cantharides, with one pound of sulphuric ether and three ounces of acetic ether; this produces a solution saturated with cantharides, as well as a fatty animal matter of a greenish color; finally, dissolve 25 grains of gun cotton in this liquid. This is the most simple method, and can be practised with the greatest ease in the laboratories of chemists.

Cantharidal collodium may be kept without alteration in well-stoppered bottles, which gives it a great advantage over other epispastic remedies, above all in journeys, and in the maladies contracted by the military in long marches, and when the application of vesicatories is judged necessary.

Although in equal quantities cantharidal collodium should be more expensive than ordinary vesicatories, it is in reality less so, because a drachm and a half of collodium produces as much effect as half an ounce of plaster of cantharides. Other practitioners have made repeated experiments with cantharidal collodium, and with uniform success.

* *Medic. Zeitg. Russlands.*

ON THE PREPARATION OF COLLODION.*

BY M. O. LIVONIUS.

THE different works published for some time past on collodion, the use of which as an adhesive and glutinous agent becomes each day more general, induced me to undertake some experiments on its preparation.

I made some gun cotton by means of fuming sulphuric and nitric acids, in different proportions; but each time the product I obtained was only partially soluble in sulphuric ether, whilst it was perfectly soluble in acetic ether. The solution in sulphuric ether possessed great adhesive properties; in the other solution, on the contrary, there was no adhesive power. The gun cotton, which did not completely dissolve in the sulphuric ether, did so immediately on the addition of a little acetic ether; but the solution thus lost all its adhesiveness. In order to obtain a product as soluble as possible in sulphuric ether, I tried preparing the gun cotton with nitre and fuming sulphuric acid. I took 200 parts of dry nitre, in very fine powder, and 300 parts of fuming sulphuric acid; I mixed the two substances in a porcelain capsule, stirring the mixture with a glass rod, and I added 10 parts of clean dry cotton as quickly as possible. After three minutes contact, during which I continued to stir it, I washed it carefully with distilled water; I pressed the cotton and dried it at a gentle heat. The gun cotton thus obtained dissolved better in sulphuric ether than that produced by the first process; still the solubility was not complete. Preserving the same proportions as before, I mixed the nitre with English sulphuric acid, and, after five minutes' contact, I continued the operation as above. By this method I obtained a product which dissolved readily in alcoholised sulphuric ether, and which gave me collodion with a remarkable power of adhesion, 5 grammes of gun cotton stirred in 110 grammes of sulphuric ether, with the addition of 20 grammes of alcohol, gave a complete and transparent solution, of the consistence of a thick mucilage of gum.

I therefore recommend this method as one of the most economical processes that can be employed.

NON-EXISTENCE OF CROTONINE.†

DR. J. WEPPER has proved that the substance obtained by following Brande's directions for preparing crotonine is not crotonine, but a magnesian soap with an alkalined re-action.

* *Archiv. der Pharmacie.*
† *Annalen der Chemie.*

POMMADE TO PREVENT HAIR FROM FALLING OFF.*

Beef marrow	1 ℥
Very pure lard	1 ℥
Sulphate of quinine	15 grs.
Essential oil, either of roses, bitter almonds, or bergamotte ..	6 drops.

FALSE VALERIANATE OF IRON.†

FOR some time past nitrate and tartrate of iron, impregnated with essential oil of valerian, have been fraudulently sold as valerianate of iron. This fraud is easily detected, as the latter is insoluble in water, and soluble in alcohol; and as hydrochloric acid, in decomposing it, separates valerianic acid, which may be readily recognised by its odor.

ON THE CURABILITY OF PHTHYSIS.‡

BY M. LECOUPPEY.

PHTHYSIS is anatomically divided into two completely distinct phases. During the whole of the first phase the cavities containing the tubercles are entirely closed, without any communication with the exterior, and, consequently, isolated from direct contact with the atmospheric air. The commencement of the other phase is marked by the introduction of natural atmospheric air into the tubercular excavations.

Every one knows that the first phase leads almost inevitably to the second, and to death, should the malady be left to itself; or, which is much the same thing, should the ordinary means be tried. And yet we have a pharmaceutical preparation under our hands which will stop the progress of tuberculisation, and cause its disappearance. This substance is *mercurial ointment*. (Codex of France, 559.)

I administer this medicine internally, ordinarily in pills; the dose from 5 to 40 centigrammes daily, half in the morning and half at night. Under the influence of this treatment the morbid phenomena rapidly decreased, and became annihilated, some of them in a uniform invariable order. Thus, hemoptysis, if it exists, disappears first; then the night sweats, then the cough ceases; finally, those symptoms revealed by percussion and auscultation; in short, the cure was complete in the course of a few months. Such, at least, is what numerous facts of my own observation have taught me, and I have no doubt that these facts will be re-produced in the practice of any who may appreciate the value of my assertions.

* *Journal de Chemie Medicale.*
† *Ibid.* ‡ *Comptes Rendus.*

HEATHFIELD AND BURGESS'S DISINFECTING APPARATUS.

THIS is a most ingenious and simple contrivance for liberating any gas to which disinfectant powers are attributed. It is a most useful apparatus for ships, hospitals, prisons, workhouses, and other buildings in which large numbers of people are collected, as well as private dwellings. It is of a very convenient size.

To liberate chlorine gas the following directions are to be observed :—

Having put the manganese into the glass basin (B), put on the wooden cover, and fix the globular vessel (A) in the orifice, and pour into the globe about a fourth part of the hydrochloric acid, turning the stopper so that its cutside may be opposite to the hole in the neck, and allow about a teaspoonful of the acid to drop from the globe; then turn the stopper so that the hole may be closed. When a further supply of gas is required the stopper may again be turned, and more acid allowed to drop into the basin.

The gas disengaged by the action of the manganese on the hydrochloric acid issues through the perforations in the wooden cover in quantities to be regulated by the requirements of the edifice to be disinfected.

COD LIVER OIL.

WE have had submitted to us, by Messrs. Langton, Brothers, and Scott, samples of cod liver oil, manufactured at Newfoundland, and also a certificate, which we subjoin, signed by Mr. Arthur Aikin and Dr. A. S. Taylor.

We are aware that cod liver oil, as frequently met with in the market, is subjected to very extensive adulteration; but the subjoined testimonial is a sufficient guarantee for this article. We regret, at this late period of the month, that we have not time to examine the samples, but will do so next month.

(COPY.)

"We hereby certify that we have examined a specimen of cod liver oil, transmitted to us for this purpose, by Messrs. Langton, Brothers, and Scott.

"The oil is of a pale yellow color, with a slight but not offensive fishy odor, and is free from any disagreeable taste. It is very fluid, and in consistency and general appearance resembles good Florence oil. Its specific gravity at 61° F. is 0.924. At the temperature of 14° F. the stearine is deposited; and the liquid oleine, when poured off the stearine, becomes gelatinous, at 10° F. It contains no free *acid*, and is perfectly neutral to reagents. In ether it is wholly soluble, not leaving behind any deposit or sediment. Alcohol of 0·815 dissolves it in small quantity. The alcoholic solution is quite colorless, and does not produce any blue color on starched paper immersed in it, thus proving that no iodine had been added to the oil. Sulphuric acid produces in the oil a rich violet pink color, indicating the presence of cholic acid, and, therefore, of biliary matter. A portion of the oil was saponified by a solution of pure soda, and the soap thus prepared was charred in a close vessel. This residue, when boiled in water, gave a colorless solution, which was found by appropriate tests to contain iodine. The quantity of iodine per cent., according to the nearest calculation which could be made, amounted to ·027, or one three thousand six hundred and thirtieth part by weight. This corresponds to the proportion assigned by other analysts.

"From these and other results, we believe that the sample sent to us is a *genuine and unsophisticated* specimen of cod liver oil.

"We are likewise of opinion, from its purity and the absence of any unpleasant odor or flavor, that it is preferable for medicinal use to those samples of cod liver oil which have hitherto come under our notice.

(Signed) "ARTHUR AIKIN,
"ALFRED SWAINE TAYLOR, M.D., F.R.S.,
"Professors of Chemistry in Guy's Hospital.
"Chemical Laboratory, Guy's Hospital, Sept. 25th, 1849."

IV. REVIEWS, NOTICES OF BOOKS, &c.

AN ENQUIRY INTO THE ACTUAL STATE OF OUR KNOWLEDGE OF CHOLERA, WITH PRACTICAL DIRECTIONS REGARDING ITS PREVENTION AND TREATMENT. By ALEXANDER KNOX, M.D., Surgeon to the Strangford Dispensary, &c., &c. Dublin: J. M'Glashan; London: Orr and Co.; 1849. pp. 266.

THIS is a most valuable work, and is really a boon to the medical profession, being a complete epitome of all that is known concerning the dread pestilence which, for a considerable period, has been destroying thousands of our fellow creatures every week.

The author commences with a history of cholera from the earliest periods, showing it to be not a new disease, but identical in all countries and in all eras, and then proceeds to consider its morbid anatomy and pathology, examining all the various symptoms in detail, its diagnosis and prognosis, its etiology and prophylaxis, and the description and comparative value of various remedies, and its treatment.

The work contains some very interesting statistical tables.

As an extract, which will best show the nature of this very valuable work, we give the author's

"RECAPITULATION.

"On reviewing the whole subject, the following propositions appear briefly to embrace the sum of our knowledge with reference to cholera. They are not, however, advanced as fixed and incontrovertible maxims, but merely as the conclusions at which I have myself arrived, founded on experience and the most careful consideration which I have been able to bestow on our present information on the subject, and, of course, liable, like all other medical opinions, to be modified by increased acquaintance with the phenomena of the disease, or the more logical deductions of future writers from the data which already exist.

1. A knowledge of the existence of a disease termed cholera extends to the earliest records of medicine.

2. Our acquaintance with this disease has, of course, become more extensive with the accumulating experience of successive ages, and been rendered still more definite by the ample opportunities for observation afforded by the epidemics of the present century.

3. The distinguishing characteristics of cholera may be enumerated as vomiting, purging, spasm, prostration, and collapse; the presence of any four of these being essential to the diagnosis of the disease.

4. Although various, other symptoms may be, and usually are, present.

5. The symptoms may occur, also, in different states of combination, and varying degrees of intensity, in cholera, as well as in all other diseases.

6. Such varieties of type appear to be dependent, partly on individual susceptibility, and partly on the intensity of the predisposing and exciting causes, the result being to modify the appearance of the disease to such an extent as to render the identity of its forms a subject of disputation.

7. The identity of cholera, however, on all sides, and in all places, may be inferred from the invariable presence, in every case, of the essential symptoms before alluded to, as well as from the co-existence of different types of the malady during the same epidemic, and our knowledge of the conversion of one form of the disease into another.

8. Consequently, it appears erroneous to term cholera a new disease.

9. As in all other diseases, the causes of cholera are to be sought for, partly in constitutional susceptibility, and partly in a combination of various predisposing and exciting influences.

10. The reasons which render one individual naturally more liable than another to a particular disease, as well as the agencies which may diminish or increase such predisposition, are generally complex and frequently obscure.

11. With reference to cholera, the predisposing causes are supposed to depend on a combination of impure and damp air, deficient light, defective or inappropriate food and drink, excessive toil, insufficient clothing, exposure to atmospheric vicissitudes, intemperance, want of cleanliness, chronic disease, constitutional debility, old age, poverty, fear, and other depressing passions, and an irritable and lax condition of the alimentary mucous membrane.

12. The causes in question, however, appear to resolve themselves principally into

any agency tending, directly or indirectly, to lower the vital organs, and to induce derangement of the system generally, or of the digestive apparatus in particular.

13. Assuming that the true and only predisposing causes are those above stated, the means of prevention are obvious, and include proper and sufficient food, free access of light, pure dry air, personal and domestic cleanliness, ample, but not inordinate, exercise, suitable clothing, an adequate supply of fuel, due regulation of the bowels, and strict temperance.

14. The chief object of judicious sanitary laws, therefore, is to make provision, so far as practicable, for effecting the measures here indicated, and to rectify errors in our mode of living; and is to be carried out by promoting improvements in the habits of the people, and in the construction of towns and individual dwellings, by diminishing the large masses in which the people are aggregated, by the removal of refuse, and by securing effective drainage and an ample supply of pure water.

15. The various assigned exciting causes of cholera may be arranged as, direct irritants of the alimentary canal, atmospheric vicissitudes, different meteorological phenomena, some hurtful condition of the atmosphere, however arising, or some unknown cause.

16. The arguments, however, by which the influence of these various causes have been supported, are extremely inconclusive. That the atmosphere is the medium through which the exciting cause of cholera, whatever it may be, gains access to the living economy, appears certain; but, beyond this, the nature of the cause in question, although probably a specific virus, appears to me to be totally unknown.

17. With reference to human contagion as a possible means of diffusing the disease, it may be looked on as determined that its transmission is not solely attributable to that principle; and, without going the length of asserting absolutely that cholera is not a contagious disease, it may be stated, that the proofs brought forward in affirmation of the question, appear quite insufficient to establish the point, the weight of observation and inference being, in my opinion, greatly opposed to it.

18. If this view be correct, it is evident that quarantine laws are founded on erroneous principles; but, in any case, they have been demonstrated, by ample experience, to be ineffectual for their purpose as regards cholera, and, consequently, they may with propriety be relinquished.

19. It appears well established, however, that in many instances, at least, the exciting cause of cholera is strictly local in its operation; and removal, therefore, beyond the sphere of its influence appears to offer a reasonable prospect of escaping an attack of the disease, and which has, on several occasions, been realised in practice.

20. Cholera is not incurable, being, in many forms, as amenable as any other disease to the resources of medicine.

21. The probable success of suitable remedies may be estimated in a direct ratio to the early stage of the disease at which they are employed.

22. It must be admitted, however, that even up to the present hour medicine appears to have little effect on the most malignant forms of the malady, especially in its advanced stages.

23. The most successful treatment of cholera appears to depend not on the application of any specific remedies, or on the inordinate employment of powerful medicines, but on the skilful selection, judicious combination, suitable adaptation, and efficient administration of various means of cure.

24. The general prognosis in cholera is not favorable; but the apparent is, in most recorded cases, greater than the real mortality, owing to many of the slighter cases not being classified with this disease, and, consequently, omitted in the returns.

25. It appears that, of all persons attacked, about one-half perish; but the absolute mortality is not very alarming, for the number of persons attacked, in proportion to the population, is less than in typhus fever and various other epidemics.

These propositions may be taken as an attempt to answer the questions contained at the beginning of the work."

No medical practitioner should be without this work, giving, as it does, the fullest information we possess concerning a disease about which it is very necessary that we should know more.

CLINICAL LECTURES, delivered in the Theatre of Mercer's Hospital, during the Session of 1847-8. By James F. Duncan, M.D., T.C.D., &c., &c., &c. Dublin: James M'Glashan. London: Orr & Co., 1849. Pp. 122.

THIS is a reprint from the Dublin medical press, of lectures delivered by Dr. Duncan, at Mercer's Hospital, Dublin. The subjects embraced are—Diarrhœa — Emphysema — Chlorotic Anasarca—Spinal Arachnitis—Albuminous Urine—Apparent Phthysis—True Pneumonic Abscess — Double Pleuripneu-

monia Latent—Pleuritis, with Effusion—Valvular Disease of the Heart—and Pulsatory Abdominal Tumor.

We feel assured that these lectures will be perused with interest by our medical readers, to whom we recommend them with the most perfect satisfaction. They are eminently clear and succinct in their details, and contain a great amount of information, conveyed in a style capable of fixing it in the memory, and are in every way worthy of the talented practitioner by whom they were delivered.

REFLECTIONS ON ORGANIZATION; OR, SUGGESTIONS FOR THE CONSTRUCTION OF AN ATOMIC THEORY. By HENRY FREKE, A.B., M.B., T.C.D., M.R.I.A. London: Orr and Co. Dublin: James M'Glashan. 1848. Pp. 80.

"HAVING been engaged," says Mr. Freke, in his preface, "some time back in analysing for Sir Henry Marsh the blood of some of the clinical patients in Steevens' Hospital, the thought was suggested to him of hazarding some observations of his own on the physiology of that fluid."

He then conceived the design of tracing man progressively through the distinct stages of his development: from the time of conception through utero-gestation to the period of his birth; from that time to maturity, during the period of his adaptation for the reproduction of his species; and thence to have followed him in his progress towards decay. His object was to have pointed to what he conceived to be the physiological stages of each of these periods, calling attention to what he regarded as the functions respectively of our so-called incidental constituents; namely, of potash and soda, of lime and magnesia, and of phosphorus and sulphur; while the motive which chiefly induced him to embark in such inquiries was the development of certain views having a relation to practical medicine, and more especially to inflammation, as well ordinary as that called specific.

He had proceeded in his investigations so far as to lead to the Reflections now published. In 1847, the Central Board of Health in Ireland appointed him Inspector of the Government Hospitals throughout the country, under the temporary Fever Acts, and thus withdrew his attention from such pursuits; and having contracted malignant typhus fever in the discharge of his official duties, he was compelled to leave Ireland for a time, and to defer them still further; and now he is under the necessity of abandoning the field to other labourers, which we regret, as he is evidently a person competent to have thrown considerable light on a very important subject. This work is but an outline, and we hope that it may some day be filled up.

The book is worth reading: it is highly argumentative, and is written in a style of true elegance.

BOOKS RECEIVED.

"Electricity as a Cause of Cholera, or other Epidemics, and the relation of Galvanism to the action of Remedies." By Sir James Murray, M.D., T.C.D., and Ed., and M.R.C.S., Edinburgh, Inspector of Anatomy. Dublin: M'Glashan; London: W. S. Orr and Co.

[This work is on too important a subject to be noticed this month, when we are very much hurried, and occupied by the labor consequent on bringing out a first number.]

"Elements of Chemistry." By Sir R. Kane, M.D., President of the Queen's College, Dublin, &c., &c., &c. Second edition, enlarged. Dublin: Hodges & Smith, Grafton-street; London: Longmans, Paternoster-row.

[We shall enter into the pleasing task of noticing this work next month, as it was read too late to do justice to it in this number.]

TO CORRESPONDENTS.

"MEDICUS."—We will attend to your request.

"A. B." must send us his name and address, and we will write to him.

"CHEMICUS" will find chlorate of potassa answer his purpose.

"A CHEMIST" (Dublin), complains of the bad empyreumatic odor of the sesquicarbonate of ammonia made from soot. This is owing to its having been manufactured in a very stupid manner. Do you know who made it?

"ALPHA."—Non-chemicus.—Tannate of lime is formed by operating as described. This substance is nearly insoluble and formed the "scum" observed. The changes of color noticed is produced by the action of the chlorine upon the tannin. The employment of a mouth-wash, prepared as mentioned by our correspondent, would be useless. The action of the tannin is entirely destroyed.

NOTICE.—*All Communications and Books for Review must be addressed* "To the Publisher of THE CHEMIST, 17, Surrey-street, Strand, London." *Communications must be pre-paid, and sent before the* 15*th of each month. Books for Review before the* 10*th.*

THE CHEMIST.

[NEW SERIES.]

I. CHEMISTRY.

NOTICE OF A NEW CHEMICAL EXAMINATION OF KILLINITE.*

BY JOHN WILLIAM MALLET, ESQ.

THE substance known to mineralogists under the name of killinite was discovered, in 1817, by the late Dr. Taylor, who read a paper on the subject before the Royal Irish Academy, on the 23rd June of that year, containing a description of the mineral, with its analysis by Dr. Barker, Professor of Chemistry to the University. It has been since analysed by Captain Lehunt and Mr. Blythe, pupils of Dr. Thompson. The results of these three analyses were as follow:—

	Dr. Barker.	Capt. Lehunt.	Mr. Blythe.
Silica	58·49	49·08	47·925
Alumina	24·50	30·60	31·041
Protoxide of iron	2·49	2·27	2·328
Lime	—	·68	·724
Potassa	5·00	6·72	6·053
Protoxide of manganese ..	—	—	1·255
Magnesia with manganese ..	—	1·08	·459
Magnesia, lime, and iron	·50	—	—
Water	5·00	10·00	10·00
	95·98	100·43	99·795

Having in my possession some pure specimens of the mineral, I thought it worth while, during a course of analytical instruction under Dr. Apjohn, to make another examination of the mineral, the account of which is the subject of the present short notice. This mineral derives its name from the first and only locality in which it has been found, namely, Killiney, near Dublin, where it exists imbedded in course granite, and accompanied by crystals of feldspar, garnets, spodumene, and black tourmaline. The specimen on which the following experiments were made was found in the cutting recently made by the Wicklow, Wexford, and Waterford Railway Company, on the south-eastern side of Killiney Hill.

The physical characters of the mineral, as exemplified in this specimen, are as follow. It occurs in small masses, having a foliated structure, and in irregular crystals. It gives by cleavage a rhombic prism, whose angles are about 135° and 45°, as determined by the common goniometer. The fracture is uneven. The color varies from a light to a dark olive green, with a shade of brown.

The crystals are frequently found covered with a brownish yellow coating of peroxide of iron, probably owing to decomposition of the mineral. The streak is white, with a slight tinge of yellow. The lustre is vitreous, but dull.

The mineral is slightly translucent on the edges, but opaque in mass. It is sectile. Its hardness is nearly, but not quite equal to that of crystallised fluor spar.

The specific gravity, as determined by three experiments on different carefully selected specimens, was found to be as follows:—

No. 1	2·6603
No. 2	2·6526
No. 3	2·6553
Mean	2·6561

This mineral does not attract the magnetic needle. When rubbed on woollen cloth it becomes positively electric. The intensity of its electricity, however, is low. It does not phosphoresce by the application of either friction or heat. The nitric and muriatic acids act on it but slightly, chiefly extracting the oxide of iron which it contains. Sulphuric acid, however, decomposes it, setting silex free.

* Read before the Geological Society of Dublin, April 11th, 1849.

Before the blowpipe it presented the following phenomena:—Heated in either an open or closed glass tube, it turns black, and gives off a sublimate of water. Alone on charcoal, or in the platina forceps, it turns white, intumesces, and fuses with some little difficulty into a snow-white porous enamel: with carbonate of soda on charcoal, it easily fuses into a brownish-green semitransparent bead, which, with a larger quantity of soda, becomes opaque. With microcosmic salt on the platina wire, it gives a transparent colorless glass. Added in great excess, it gives in the oxidating flame a glass which is transparent, and of a light yellow color when hot, but which becomes nearly opaque, and assumes a smoke-gray color when cold. With borax it behaves in the same manner. On the platina wire, with a mixture of bisulphate of potash and fluor spar, it gives the purplish-red flame characteristic of lithia, slightly but distinctly.

CHEMICAL ANALYSIS.

To obtain information as to the chemical constitution of the mineral, the following analysis was made in the Laboratory of the College of Surgeons, under the superintendence and direction of Dr. Apjohn. The method adopted for the estimation of its earthy constituents was as follows:—28·89 grains of a pure specimen were pulverised and strongly ignited, for the purpose of determining the water. This same portion was then fused with about three times its weight of a mixture of carbonate of soda and potassa. The fused mass had a light blueish-green color and radiated structure, very much resembling some species of Wavellite. It was then dissolved in muriatic acid; the solution evaporated to perfect dryness, water digested on the residue, and the silica filtered out. From the filtered solution, the iron and alumina were precipitated by ammonia, and these afterwards separated by caustic potash. Oxalate ammonia was then added to the remaining solution, which precipitated the lime, thus completing the first part of the analysis, there being no perceptible traces of manganese or magnesia. By these means the following results were obtained:—

28·89 grs. contain		per cent.	
Silica.....	15·28	Silica.....	52·89
Alumina	9·60	Alumina	33·24
Protoxide Iron	·95	Protoxide Iron	3·27
Lime.....	·42	Lime.....	1·45
Water	·106	Water	3·67

For the purpose of determining the alkalies, recourse was had to the decomposing agency of hydro-fluoric acid; the vapor of which was made to act upon fifty grains of the mineral moistened with pure water, in the manner pointed out by Brunner.

By this method it was completely disintegrated, the silex being dissipated in the vaporous state, and the other constituents of the mineral converted into fluorides. Sulphuric acid was then poured on, and the whole evaporated to dryness. Being redissolved in water, ammonia and carbonate of ammonia were added to it, which precipitated every thing but the alkalies. The solution was then filtered, evaporated to dryness, and ignited to expel the ammoniacal salts. The alkaline sulphates were weighed, re-dissolved in water, and converted into chlorides, by the addition of chloride of barium. The solution being again evaporated to dryness, they were weighed as chlorides, which, having been dissolved in water, the potash was precipitated by chloride of platinum. The residual solution was then freed from the excess of chloride of platinum, by sal-ammoniac, filtered, evaporated to dryness, and ignited, when it left a small portion of chloride of lithium, which was weighed as such, there being no soda present. By this analysis the alkalies were found to be—

In 50 grs.		= per cent	
Potassa	2·47	Potassa	4·94
Lithia	·23	Lithia	·46

Hence we find the constituents of the mineral in one hundred grains to be as follow:—

Silica	52·89	1·135
Alumina	33·24	·647
Protoxide Iron	3·27	·91
Lime.....	1 45	·005
Potassa	4·94	·105
Lithia.....	·46	·030
Water.....	3·67	·408
	99·92	
Loss	·08	

Dividing each of these numbers in the first column, by the atomic weight of the body whose quantity it represents, we obtain the numbers given in the second column above, showing the equivalent proportion in which those bodies exist in the mineral.

Or throwing the lime, potassa, lithia, and protoxide of iron into one, we have—

	Rel. Prop.
Silica ..... 1·135	5
Alumina .... ·647	3
Protoxides .. ·231	1
Water ..... ·408	2

Dividing each of these by the lowest number, their relative proportions are very nearly as above, which leads to the formula—

$$M\,O,\ 2\,Si\,O^3 + 3\,(Al^2\,O^3\,Si\,O^3) + 2\,H\,O$$

representing the protoxides by $M\,O$.

This formula differs so materially from that of Spodumene—$2\,(Al^2\,O^3\,Si\,O^3) + 2\,Li\,O,\ Si\,O^3$—which is the only mineral liable to be confounded with Killinite, as, I think, to entitle the latter to be considered as a *distinct* mineral species, most nearly allied, however, to Spodumene, and ranking in a chemical arrangement under the alumino-alkaline silicates. The analysis appeared to be worthy of a brief record, as preceding analysis continued the question in doubt of Killinite being classed in mineralogical treatises as a distinct mineral. It likewise possesses some interest in another point of view, as demonstrating the presence in this mineral of the rare alkali, lithia, which has hitherto been found in but small quantity, and sparingly distributed in nature.

GENERAL CONSIDERATIONS ON THE ELECTRO-CHEMICAL THEORY.*

BY M. BECQUEREL.

When the principles which serve as the bases of a theory are still matter of controversy, and when new discoveries daily throw light on their nature, it is good philosophy occasionally to submit them to fresh discussion, to ascertain whether they should be maintained or modified: such is the object I have proposed to myself in the memoir which I have now the honor of presenting to the Academy, on the electrical effects produced in chemical actions, and in the contact of bodies in general; effects which were adduced but a few years back by one of the great scientific lights of Europe, to demonstrate the electrical state of atoms before and after their combination, and, consequently, the identity of affinities with electrical forces. This subject has unceasingly occupied my attention for thirty years, in an experimental point of view, and, consequently, abstracted from every pre-conceived idea concerning the nature of atoms, the most direct means of arriving at the truth.

I will first recapitulate the electro-chemical theory, as I explained it in 1840 (*Traité Experimental de l'Electricité et du Magnétisme*, tome VI., page 333), in order that my replies to the objections made to it may be better followed.

Are the action of heterogeneous particles on each other, in chemical actions, as well as that of similar particles in aggregation, due to electrical forces, or to forces proper to matter, and whose nature is unknown to us? This question has, for more than forty years, been agitated between natural philosophers and chemists; a question raised by Davy, developed by Berzelius, who made it the basis of his electro-chemical theory; explained by Ampère in another point of view; disputed by several chemists, and reduced to its just estimation by the discussion of facts.

Davy, in the Bakerian lecture of Nov. 10, 1806 (Philosophical Transactions, 1807), explained his views concerning the relation which he supposed to exist between affinities and electrical forces. Among the substances which combine chemically, all those whose electrical energies are well known, manifest, says he, opposite electrical states by their mutual contact, and, supposing a perfect freedom in the motion of their elementary particles, they should attract one another by virtue of their electrical powers. *Supposing, therefore, two bodies, whose molecules are in a different electrical state, and that these states are sufficiently exalted to give them an attractive force superior to the power of aggregation, a combination is formed which will be more or less powerful as the energies are more or less perfectly balanced, and the change of properties will correspond proportionally.* At the same time, there is an immediate re-composition of the two electricities, and a disengagement of heat, which is the result of it.

Berzelius, who admitted this doctrine, regarded electricity as an ethereal fluid, of unknown nature, diffused throughout Nature, penetrating all bodies with the same facility as light passes through glass, and dividing itself, in certain circumstances, into two principles endowed with diametrically opposite properties, and bearing no analogy to matter, of which it is not even a property, in that it is transmissible from one body to another. Entirely acknowledging the mutual independence of electricity and matter, he nevertheless admitted between them an intimate relation. Berzelius afterwards compared atoms to small electric piles analogous to tourmalines, which acquired polarity by heat, supposing, besides, that the two poles had not the same intensity; he thus made the combination of heterogeneous atoms to depend on the attractive action of poles of contrary names, whose electrical state was exalted by heat. I will recur to this polarity.

Ampère supposed that atoms possessed an electricity of their own, of which the speci

* *Annales de Chimie et de Physique*, Sept., 1849.

depended on the part which they enacted in combination, and which they could not lose without ceasing to exist; that this electricity was disguised by an atmosphere of contrary electricity, when they made no part of a combination; that hydrogen, the alkalies, and the oxides were electro-positive—oxygen and the acids electro-negative.

Before discussing these systematic views, I will recapitulate the principal facts serving to establish a dependence between affinities, the force of aggregation, and electrical forces. When we cleave, with suitable precautions, a crystal of a substance which is a bad conductor of electricity, each part separated carries with it an excess of contrary electricity, arising from the destruction of the aggregation. In operating in the dark, especially with plates of mica, a feeble light, due to the re-composition of the greater part of the electricities disengaged, is perceived.

In the same circumstances, crystallised conductors give no electricity, because those which are disengaged re-combine immediately, before having acquired sufficient tension for producing light.

In friction the disengagement of electricity arises from a derangement in the equilibrial position of the molecules; surfaces whose particles have most flexibility have a tendency to acquire negative electricity, whilst those whose particles are less easily displaced ordinarily take positive electricity. I say ordinarily, because we cannot erect into a general law those results which sometimes depend on causes which elude all investigation. Pressure produces analogous effects, which are so much the more marked, as the surfaces have adhered more to each other; and when they are separated, a kind of cleavage is produced, and, consequently, electrical effects analogous to those produced in cleavage. It is evident, then, that by destroying molecular attraction, there is a disengagement of electricity; and, on the other hand, when an isolated conducting body is submitted to the action by influence of an electrised body, an excessively small portion of its natural electricity is decomposed, the two electricities which proceed from it re-combine as soon as the electrised body is removed. This action is so much the more energetic, as the first is a better conductor, as the latter has a more powerful tension, and as the bodies approximate more, whilst the electrical attractions and repulsions are exerted in the direct ratio of the quantities of electricity, and in the inverse ratio of the square of the distance. At the same time, the forces which unite the molecules are weakened, and so much the more as the action is greater; cases occur in which it has even power to separate them. The decomposing action of the pile is an example of it, and lightning, when it strikes these objects, furnishes many instances. The general facts which I have just related indicate relations between chemical forces and electrical forces, which relations will immediately become more extended, but which already show the existence of two electricities in the molecular interstices of bodies, as well as their expansion when the natural equilibrium of the molecules is disturbed by mechanical actions, or actions by influence.

This quantity of electricity, which resides in the interstitial spaces, and which is indispensable to the constitution of bodies, is capable of alarming the imagination, as I will presently show: it may serve to reveal to us the degree of force by virtue of which affinities retain in contact heterogeneous atoms. I pass to the relations observed between electricity and heat. Every time that heat is propagated in a closed metallic circuit, and that it meets with an obstacle to its free propagation, a disengagement of electricity results, which is rendered sensible by the production of an electric current, whose direction indicates that positive electricity ordinarily overcomes the obstacle. It would seem, then, that heat, when it is not freely propagated in a body, is decomposed into two elements, positive electricity and negative electricity; at least, if it is not so, it appears so.

Reciprocally, when the electric fluid circulates in a body, if it meets with an obstacle to its passage, heat is immediately produced on it at the precise spot where the resistance exists. This reciprocity of electrical and calorific effects during the motion of heat and electricity in bodies, establishes a mutual dependence between these two agents.

But as heat, in dilating bodies, produces a commencement of cleavage, and, consequently a disengagement of electricity, the two electricities having become free, in recombining, if the bodies are bad conductors, give rise to luminous effects analogous to the phosphorescence produced in the same circumstances; or else, if they are conductors, to electric currents, as, for example, bismuth, antimony, iron, &c.

This more or less immediate re-composition of the two electricities likewise occurs when crystalline bodies, which are bad conductors, are bruised in an agate mortar, because lamellæ possessing some positive and some negative electricity are always in contact.

In some regularly-crystallised substances, such as tourmaline, topaz, &c., heat deter-

mines a distribution of electricity, as in electrical piles; these crystals are then endowed with polarity, which exists, however, only in proportion as the temperature is raised or lowered, for it disappears when it is stationary. In this case the electrical effect is the result of the dilatation or contraction of the molecules.

We cannot, therefore, compare the electrical properties of atoms with those of a tourmaline, since, in the latter, these properties are only transient; whilst, according to the ideas of Berzelius, they would be always augmented by heat in the atoms, whether the temperature were stationary or not.

Experience teaches us also that heat seems to be propagated in bodies by a series of decompositions and re-compositions of natural fluid, which are operated in such a manner that the particle which is first heated takes from the source of heat positive electricity, and transmits to it negative electricity: this particle behaves, with regard to that which follows it, as the source of heat did to it; and so on until the temperature has become the same throughout all parts of the body.

Now, as heat is propagated in bodies by radiation from molecule to molecule, we are induced to believe that this radiation is operated likewise by a series of de-compositions and re-compositions of natural fluid.

Finally, the thermo-electrical phenomena produced in closed metallic circuits show us likewise intimate relations between heat and electricity, in which the conducting power and specific heat concur.

Davy is the first, as I have already stated, who expressed the opinion that heat was formed by the union of the two electricities. He endeavored to demonstrate it by means of his remarkable experiments on heat and light produced *in vacuo*, by the discharge of a very powerful pile between two charcoal points; but as, in this experiment, the two electricities carry with them material particles, it is not known to what point these latter intervene in the production of calorific and luminous effects. It might, indeed, be that the electricity impresses, by means of its excessive velocity, such a vibratory motion on these particles that they become apt to emit an enormous quantity of heat and light. At any rate, it must always be borne in mind that electricity, when it passes from one body into another, always carries with it matter; and that when the secondary medium, or the conductors, cannot furnish it to it, the calorific and luminous effects cease to be manifested, and the electricity escapes in the state of diffusion, which happens in vacuo over mercury or other liquids which are not sensibly vaporisable.

In order to estimate precisely the relations existing between heat and electricity, I will detail the two laws which govern the disengagement of heat produced by the passage of electricity into the metal wires.

First Law.—Whatever may be the length of a metallic wire, if its diameter is uniform, and the quantity of electricity invariable, the elevation of temperature is the same at any point whatever.

Second Law.—The quantity of heat produced is in the direct ratio of the resistance to conductibility, and proportional to the square of the quantity of electricity which passes.

These two laws establish well the relations which connect together electricity, heat, and matter. I pass to the relations which exist between affinities and electrical forces, which relations will complete all the data on which we should rely for establishing an electro-chemical theory.

When an acid is combined with an alkali, the former liberates positive electricity, and the latter negative electricity: these two electricities, with the exception of the very small quantity which the apparatus removes, immediately re-combine in the liquor to form again neutral fluid. Now, as in the same circumstances there is a production of heat, it has been thought that the heat must be caused by this recomposition, which being effected by the medium of material particles which occur in the passage of the two electricities, gives rise to an infinity of partial currents, which disengaged so much the more heat as the chemical action was more vivid, and the material particles conducted less electricity. This is only an hypothesis, it must be admitted, but it is an hypothesis to which Mr. Joule has endeavored to give some confirmation by maintaining, by aid of some experiments, that the heat disengaged in combustion is produced by the resistance which electricity experiences in passing from oxygen into the combustible body at the moment of combination.

If the law advanced by Joule was verified in all chemical actions, it would be proved that the heat disengaged in the reaction of two bodies on one another is due to the resistance which the two electricities experience when set free, in recombining by running through the material particles which are found in their passage.

In the oxidation of a metal, or of another body, oxygen acts like an acid, the metal or other body like an alkali.

In general, when two bodies react on each other, that which acts the part of acid disengages positive electricity, and that which acts as an alkali, negative electricity.

In decomposition, the chemical effects are inverted; that is to say, the acid disengages negative, and the base positive electricity. It is evident, then, that affinities and electrical forces are always concomitant and in mutual dependence. In double decompositions, there is no disturbance of the equilibrium of the electrical forces, since it is impossible to collect the slightest traces of electricity with the most delicate apparatus.

An acid solution, with respect to water, behaves like an acid in combining with an alkali or an oxide, and the latter like an alkali. An alkaline solution acts towards water as an alkali towards an acid; thus, in one case, water behaves like an alkali, and in the second like an acid.

A saturated neutral solution acts like an acid with regard to the same solution diluted; now, as there is no combination, it is evident that it can be only a molecular motion which produces the electrical effects.

Gases, in their re-action on water, likewise give rise to electrical effects subject to the same laws. To be convinced of this, it is sufficient to take two sheets of platinum, connected with a multiplier, covered one with oxygen, the other with hydrogen, and to dip them simultaneously into water. A current is immediately manifested whose direction indicates that the first takes from the water positive, and the second, negative electricity; the effects are also the same when only one of the two plates is covered with oxygen or hydrogen.

The phenomena of combustion make no exception to the general rule.

It is evident that chemical actions of whatever nature, produce, at the moment of their being exerted, electrical effects subject to simple laws, against which some objections have been made which I shall prove further on to be unfounded.

To return to Ampère's theory, which was favorably received at the time of its enunciation, but which by no means satisfies the requirements of science. The acids, I have already said, are eminently negative bodies, surrounded by atmospheres of contrary electricity, from which they are freed at the moment they enter into combination, to take it again from the surrounding bodies when the combination is destroyed, whence result, in both cases, inverted electrical effects: the alkalies give rise to opposite effects.

This hypothesis explains much better than that of Berzelius the electrical effects observed in chemical actions, as well as the permanence of the contact of the atoms so long as the combination lasts, since this is the consequence of the reciprocal attraction of the two contrary electricities proper to the atoms; but we must go no further. Indeed, if acids are always electro-negative and alkalies always electro-positive, and if the contact of the atoms in the combination be due to the attractive action of two contrary electricities, why, as we have so many examples, do certain acids behave like alkalies to other acids, and thus become electro-positive? Why does an alkali or an oxide likewise act as an acid towards another oxide, so as to become electro-negative, although electro-positive at first? Ampère, to solve this difficulty, supposed that atoms, independent of their own electricity, also possess, like all other bodies, a certain portion of natural electricity, by means of which effects are produced similar to those observed when we put together two bodies very unequally charged with the same kind of electricity; in this case, the repulsion is converted into attraction. The difficulty may be solved by adopting the electrical polarity of Berzelius; but again suppositions, again hypotheses, to explain phenomena which depend, probably, on very simple causes! Let us put away these theories, and devote ourselves to studying absolute facts and the consequences which flow from them.

The decompositions by means of the pile also throw some light on the electrical state of atoms in combination, since they teach us that affinities are destroyed by electrical forces, that the action of the latter is definite, and that a substance can be transported to one of the poles, only inasmuch as it is combined with another substance having a tendency to go to the other pole; phenomena which indicate that the electrical state of atoms is only disguised in the combinations, as Ampère thought, or else that it is the result of an action by influence on the part of the electricity in motion in one as in the other case; it is evident that if electrical forces do not constitute affinities, these two kinds of force have, nevertheless, such relations with each other that the second may be weakened, destroyed, or augmented by the first.

This property of electricity in motion of acting on a substance in solution only when it is combined with another substance, having a tendency to pass to the other pole, gives evidence of dualism, or the mode of combination by antagonism. If this mode of combination did, indeed, exist, how would the electro-chemical decompositions of organic or inorganic compounds always present the peculiarity of being effected in two distinct parts, possessing opposite properties, and which, united by affinities or electrical forces, where there was no formation of secondary products, reproduce

those same compounds? If we continue to explain the relations which connect these two kinds of forces, we see that the chemical action of the current is definite in that even the equivalents of bodies are associated with equal quantities of electricity, and that the influence of masses is exerted in electro-chemical decomposition, as in ordinary chemical actions. If we passed an electric current into a mixture of two saline solutions, according to their proportions and the intensity of the current, the salt, whose elements are united by virtue of the lowest affinities, is entirely or partly decomposed, whilst the other salt is not at all affected, or only partially so.

If we had the means of estimating with great accuracy the quantity of electricity which appears to be associated with atoms in combinations, which is necessarily equal to that which the pile must put in motion to operate their separation, we might compare the affinities with each other, with regard to temperatures, the influence of masses, &c.

In the considerations which I have just presented, I have said that there is a disengagement of electricity in the contact of two bodies only when there is chemical action, difference of temperature, or mechanical or molecular action, whence I have concluded, as De la Rive had formerly done, that the equilibrium of electrical forces is disturbed only when matter is put in motion by any cause whatever. The effects of static electricity, which take place on the contact of gold and platinum, were opposed to this general rule. But these effects, as Edmund Becquerel has demonstrated, are not due to the simple contact of these two metals; indeed, if two plates of a condenser, one of platinum, the other of gold, be placed over one another, then put in communication, by means of a galvanic *circuit*, a charge of electricity is always obtained; the platinum is negative, and the gold positive. On submitting a plate of zinc to the plate of gold, the platinum is still negative; but if, instead of establishing the communication with a metallic arc, it be made with the fingers moistened, we have inverted effects.

According to De la Rive, platinum, in being very slowly oxidised, is thus found in a negative state. He bases his opinion, in this respect, on the fact, that electrical effects diminish in proportion as the layer of varnish, which prevents the air from acting so strongly on this metal is augmented.

(*To be continued.*)

ON THE PRESENCE OF FLUORINE IN SEA WATER.*

BY G. WILSON, M.D.

THE author, in the year 1846, announced to the Royal Society of Edinburgh that he had discovered fluorine in sea water. He was induced to seek for it by observing that fluoride of calcium is slightly, but evidently, soluble in water, which explains its occurrence in rivers and springs, and renders necessary its occasional, if not invariable, presence in the sea.

The only specimens of sea water he had examined, until this summer, were taken from the Frith of Forth, at Joppa, three miles from Edinburgh. He procured the mother liquor, or bittern, from the pans of a salt work there, and precipitated it by means of nitrate of baryta. The precipitate, after being washed and dried, was heated with sulphuric acid in a leaden basin, covered with glass having designs on it. The latter were etched, in two hours, as deeply as they would have been by fluor spar acted on in the same manner; the lines were filled up with the white silica separated from the glass.

Dr. Wilson recently examined, in the same manner, some bittern from the salt works of Saltcoats, in the Frith of Clyde, but the indications of fluorine were far less distinct than in the waters of the east coast. However, he found no difficulty in detecting fluorine in the incrustations on the bottom and sides of the boilers used in the evaporation of sea water. This incrustation, or deposit, consists, for the most part, of sulphate of lime, and of carbonate of lime and magnesia, but it likewise contains much chloride of sodium, and the other soluble salts of sea water. Consequently, when sulphuric acid is poured on, much hydrochloric and carbonic, and some hydrofluoric acids are evolved, and the latter is thus driven away before it has time to corrode the glass deeply. He preferred, nevertheless, to use the deposit exactly as he found it, in order that the proof of the presence of fluorine might not be impaired in validity by the possibility of that substance being introduced in the water or re-agents which would require to be employed had the chlorides and carbonates been separated from the crust by a preliminary process. The crust, accordingly, after being dried and powdered, was placed with sulphuric acid in a leaden basin, covered with a waxed square of plate glass. A single charge of crust and acid corroded the glass very slightly, but, on adding successive quantities, the same plate of engraved glass being used, he found

* British Association—Chemical Section.

no difficulty in etching the glass deeply. Operating in this way, he readily found fluorine in the boiler deposit from the waters of the Friths of Forth and Clyde.

It is a less easy matter to subject the waters of the open sea to the degree of concentration necessary for the examination.

It occurred, however, to Dr. Wilson that the incrustations which are periodically removed from the boilers of the ocean steamers would serve to determine the question whether fluorine is a general constituent of sea water. He applied at Glasgow and Leith for the deposits in question; but, as the deep-sea boats which leave Glasgow have their boilers cleaned out at other ports, he has not been able to obtain crusts from the west coast of Scotland.

At Leith he procured some crust from the boiler of the Isabella Napier, which trades between Leith and Wick, so that the greater part of the water consumed is derived from the German Ocean, although a portion is necessarily from the Frith of Forth.

This crust, treated as above, at once yielded hydrofluoric acid. A single charge marked the glass distinctly, and four charges deeply.

It may, therefore, be inferred that fluorine is present in the water of the German Ocean, for different portions of the deposit readily yielded it, and marked the glass as deeply as the water from the Frith of Forth did, which could not have been the case had not the fluorine been diffused pretty equally throughout the coast. From what is known of the comparative uniformity in the composition of sea water, it may safely be inferred that, if fluorine be present in the waters of the Friths of Forth and Clyde, and in the German Ocean, it will be found universally present in the sea.

Mr. Middleton, before 1846, arrived at the conclusion that fluorine must be present in sea water, since it occurred, as he ascertained, in the shells of marine mollusca. Mr. B. Silliman, jun., unacquainted with Mr. Middleton's opinion, drew the same inference from its invariable presence in the calcareous corals brought to America by the United States' expedition from the Antarctic Seas.

The author found fluorine abundantly present in the teeth of the walrus, which points to its existence in the Arctic Ocean; and it appears so constantly associated with phosphate of lime that it may be expected to occur in the bones of all marine and terrestrial animals.

He found fluorine in kelp from the Shetlands, but less than he had anticipated. Glass plates were corroded only so far as to show when breathed on.

Professor Völcker, also, at the author's request, was kind enough to search for fluorine in analysing the ashes of specimens of the sea pink (*Statice Armeria*) which had grown close to the sea shore, and contained iodine; he found fluorine in this, and also in the *Cochlearia Anglica*.

When all these facts are considered, it is not too much, the author thinks, to urge that fluorine should now take its place among the recognised constituents of sea water.

Specimens of etched glass were exhibited to the Section in illustration of this communication.

Professor Forchammer confirmed Dr. Wilson's results. Mr. Pearsall thought he had detected fluorine in many waters from rivers and springs.

COMPARATIVE STUDY OF THE AURIFEROUS SANDS OF CALIFORNIA, NEW GRANADA, AND OF THE URAL.*

BY M. DUFRENOY.

(*Concluded from page* 14.)

SANDS OF THE URAL.

I HAVE examined two varieties of sand from the Ural, which had been sent to M. Becquerel by the Russian Government, of which he sent samples to the Museum of Natural History; the other collected by M. Le Play on the spot.

The first is, doubtless, a less concentrated product of washing than the second; it contains only 10 per cent. of black oxide of iron. Most of the fragments composing it are quartzy.

The second contains 22·12 of magnetic oxide of iron.

M. Le Play, attached to M. Demidoff's scientific expedition of the Ural, has communicated to me some valuable information concerning the washing of the sand, which will enable me farther on to hazard some conjectures on the richness of the Californian sand. This engineer made numerous experiments, to prove the richness of the auriferous washings of the Ural; he ascertained that the richest washings gave 0·000·0008, and that they treated the sands which contained only 0·000·0001 of gold.

The sand sent to me by M. Le Play belongs to the first kind; it had been concentrated in such a way that 100 grains of washed sand resulted from 3,200 grammes of crude sand. It contained about 0·22256 of gold.

Quartz, which was very abundant in M.

* *Comptes Rendus*, No. 8; Aug. 20, 1849.

Becquerel's sample, was comparatively scarce in this. It belonged to three varieties, namely, colorless hyaline quartz, amethyst quartz, and smoky quartz. The most abundant mineral appears to be the titaniferous oxide of iron; it is black, with a brilliant and rather resinous lustre; the grains are generally rounded and without form, so that I could not distinguish in it the specular iron. I think, moreover, that if this oxide of iron exists in these sands, it is at any rate very rare, for I could not isolate grains giving the red powder. I observed elongated grains, having a coarse prismatic form, which reminded me of mengite, a mineral very abundant in the mountains of the Ural.

Transparent grains of a greenish yellow, with a milky hue, were perceived, which appeared to belong to cymophane; I likewise saw a few crystals of white zircon, whose forms were appreciable, although the angles were very much blunted: the faces of the octahedron a' greatly predominated, and its crystals were depressed.

The grains of this variety of sand of the Ural are generally very round, and bear, consequently, traces of a long friction, and, perhaps, of removal from a great distance. Their dimensions are generally very uniform, which enabled me to count a certain number of them. The relative proportions which this single estimation gave me are as follow—

Magnetic oxide of iron	23
Titaniferous oxide of iron (mengite), &c.	50
Cymophane	10
Hyaline quartz, of different varieties	14
Zircon	3
	100

There exists, besides, iron pyrites and copper pyrites. I found the specific gravity of the sands of the Ural to be 4·53, a little higher than that of the Californian sands, which would allow them to be richer in magnetic oxide of iron and specular iron than the latter.

The composition of the sands of the Ural presents considerable differences from those of America; the latter contained 59 per cent. of magnetic oxide of iron, and the second, 23; they contained, on the contrary, 50 per cent. of titaniferous iron, whilst the other contain only 15 or 16 per cent.; but the most remarkable difference consists in the presence of cymophane to the amount of at least 10 per cent.

Zircon is also contained in it, but in very small quantity; quartz, which is one of the essential elements of every crystalline rock, is found in it in equal abundance. The proportion observed in the concentrated auriferous sand is not nearly equal to that of the crude alluvion; but the specific gravity of the quartz being only 2·7, whilst that of the magnetic oxide is 5·09, that of the zircon 4·50, and that of the cymophane 3·68, the greater part of the quartz must be removed at an early stage of the washing.

SANDS OF THE RHINE.

I have examined an auriferous sand from the valley of the Rhine, which was presented to the Museum of Natural History by M. Ménard de la Groye. The exact place from which this sand was obtained was not stated, nor was its degree of concentration known; it must be very feeble, judging, at least, from the proportion of oxide of iron separated from it by means of the magnet, which did not amount to quite 2 per cent. The remaining sand contains, also, shining black grains, analogous to the titaniferous oxide of iron; the proportion of it is small, I did not calculate it, but I do not think that it exceeded 3 or 4 per cent. The quartz is not the dominant part, but almost the absolute element, and it may be estimated at not less than 90 per cent.; it is constantly hyaline, but various in color, colorless, smoky, deep yellow and rose topaz: this last variety is abundant. In the midst of this multitude of grains of quartz some crystals of white zircon are distinguished; their angles are blunted, whilst the quartz is in angular fragments. The remarkable difference between the condition of the crystals of zircon and of the grains of quartz might, perhaps, indicate the mixture of the alluvion of different dates.

I did not observe spinel in any of the auriferous sands which I examined. Is this absence fortuitous, or, on the contrary, the result of a general cause? I should be inclined to adopt the latter opinion. I found spinel in great abundance in the stanniferous sands of Pyriac. I have also seen it in the tin washings in Cornwall; perhaps it might be concluded from this that this mineral belongs to more ancient crystalline rocks than those which contain the beds of gold.

I have announced that the accurate knowledge of the richness in gold of the sands of the Ural would enable us to form a conjecture as to that of those of California; indeed, the density of these sands being very nearly 4·37 and 4·53, it may be admitted that the operation of washing has concentrated the sands in nearly equal proportions. Now, the washed sand of the Ural contains 0·00256 of gold, the assay of the washed sand of California gave 0·0029 for its richness; the latter, although superior, is so by very little. We have also some information verifying, in some measure, this hypothesis:

Russia produced in 1847 a quantity of gold, valued at 77 millions of francs (about £3,080,000), the number of workmen employed in washing in that empire was about 50,000. From documents published concerning California, in the American and English journals, it would appear that the production of gold has amounted to four or five millions of dollars, that is from £800,000 to £1,000,000, and the number of workers to from 15,000 to 16,000. Now this is as nearly the third of 77 millions as 16,000 is that of 50,000 dollars; thus the same number of workmen produce about the same quantity of gold; there is, therefore, an analogy between the richness of the washed sands of the Ural and California, and a similar production by the workman, it is, therefore, natural to think that the auriferous diluvium of California is presented, with respect to richness, in analogous condition to other gold washings.

The important discovery of the gold workings of California may, at first, give great profits; either because the first seekers have fallen on extremely rich places, or from any other fortuitous cause; but an average of products will very soon be established, which will give to this speculation its real value.

The products of the Russian mines, which are officially known, enable us to estimate, approximately, how much each workman should obtain per day. It is sufficient to divide the number 77,000,000 by 50,000. We find by this calculation that each workman annually produces a quantity of gold corresponding to 1,540 francs (or about £62). Admitting, on account of local circumstances, that the workmen labor only 200 days per annum, the average daily produce of a workman is 7 francs and 70 centimes per day (or about 6s).

When the working of gold mines is compared with that of iron, it is remarked that the advantage is on the side of the latter. We find, indeed, in the *Comptes Rendus des Inyénieurs des Mines*, for 1847, that the production of cast iron and iron amounted, in France, for that year, to about 191,000,000 francs (£7,640,000), and that the number of workmen employed in the different works of the forges is about 33,000.* The value created by each workman in that year was therefore 5,788 francs (£231 10s). The frequent stoppages which occur in iron works, either from the scarcity of wood or the temporary suspension of the motive powers, lead us to believe that each workman labored at most 250 days in the year.

The daily produce would be, under this supposition, 23 francs 17 centimes (about 18s. 8d.) per day; admitting 300 days per year, it would be 19 francs 25 centimes (or 15s. 5d). In order to establish an accurate comparison between the advantages of working gold and those of working iron, it would be necessary to introduce into it the capital employed in each of those operations. We do not possess sufficiently complete documents for making this calculation; but we know that the working of iron requires much greater outlay in material and fuel than gold-washing does. However, it appears to me certain that the value created by each iron-smith is at least equal to that produced by the gold-seeker.

The foregoing estimations, however erroneous they may be supposed, appear to me to make it certain that the gold-working of California presents the same conditions as the workings previously well known.

The advantages are analogous, and they will depend entirely on the price of hand-labor; whilst in the working of the auriferous sands, the expenses consist almost exclusively in the transport and washing of the earths; at all events, these could not be extremely considerable, since the crude product for each workman could not be estimated at more than 9 or 10 francs per day. The discovery of gold in California will not, therefore, produce the revolution which has been supposed in mineral industry; but it will be to this new State of the American Union a source of wealth and civilisation.

* Number of workmen employed in the production of iron (*Comptes Rendus des Ingénieurs des Mines*), 1847 :—

Employed in the extraction of the ores.....	15,000
Employed in working the furnaces.....	5,000
Employed in the forges	13,000
	33,000

REPORT ON A MEMOIR, BY M. WURTZ, RELATIVE TO NEW COMPOUNDS ANALOGOUS TO AMMONIA.*

BY MM. THENARD, CHEVREUL, AND DUMAS.

The Academy has charged us to report on the work read at its sitting of the 13th of August, the principal results of which, already known to it for some months, have

* *Comptes Rendus*, No. 8; Aug. 20, 1849.

impressed all chemists by their novelty, their importance, and their clearness.

It is sufficient to say that we, the Commissioners named by the Academy, had not waited until the Academy made it our duty to study the facts with which M. Wurtz has lately enriched science, to test them and examine their entire bearing. Thus we found ourselves immediately agreed on the judgment which we now submit with entire confidence to its approbation.

There exists in the domain of organic chemistry a class of compound bodies which, from the simplicity of their formulæ, the certainty of their re-actions, and the symmetry of their relations, have, for twenty years, possessed the power of attracting all the attention, of exciting the most searching investigation, and of recompensing all efforts; an inexhaustible mine, whence flow at once the highest laws of natural philosophy and the most happy applications of practice.

This is the group of the alcohols, ethers, fatty acids, and fatty bodies, whose study has so greatly contributed to connect organic chemistry with mineral chemistry, to proving that the general laws which group facts in these two branches of science, so far from separating them, tend, on the contrary, to reconcile them more and more.

We know, from the study of the bodies which this group includes, that wood spirit $2\,HO + C^2\,H^2$ forms the first term of a series which comprises the best characterised alcohols, of which the general formula $2\,HO, nC^2\,H^2$, or more generally $2\,HO, nC^m\,H^{m-b}$, b being equal to zero, expresses the composition, and whose properties may always be foreseen, those of wood spirit being given.

We know that methylic ether, $HO, C^2\,H^2$ forms the first term of the series of ethers, of which the general expression $HO, nC^2\,H^2$ or $HO, nC^m\,H^{m-b}$, shows the relations and exact parallelism with the series of alcohols, quite enabling us to predict the proportion of the bodies which it includes, those of one, or better, two, of them being given.

We know also that $2\,O, C^2\,H^2$ or $2\,O, nC^2\,H^2$, or, more generally, $2\,O, nC^m\,H^{m-b}$ represent a number of products with which are connected essence of almonds, essence of cinnamon, aldehyde, and many other substances rich in curious and important derivatives.

We know, finally, that, under the formula $O^4, C^2\,H^2$, or else $O^4\,nC^2\,H^2$, or, more generally, $O^4n, C'^m\,H^{m-b}$, rank among the best known organic acids, from formic acid and vinegar to margaric and benzoïc acids. In this case also, the perfect symmetry of the formulæ was justified by the symmetry of the re-action, and constantly furnished the means of preserving and predicting the existence of the derivation of one of the terms of the series, from the knowledge of the derivation obtained from any one of the terms, even the most distant from that which was submitted to the proofs of experiment.

But the bodies comprised in these four series, for the most part long known to chemists, have been assimilated among themselves, and grouped into natural families only by a slow and persevering study of their properties. To discover a new series of the same nature, perhaps the most important of all, from the number and variety of its derivatives; to show, by a brilliant example, that science may enter with confidence into these paths which synthesis opens to it, is at once a great honor and singular good fortune.

Now, M. Wurtz has just revealed to chemists the existence of a new series of compounds, which, setting out from ammonia, are ranged under the general formula which we see so constantly reproduced in all the foregoing cases, $NH^3, C^2\,H^2$, or else, $NH^3, nC^2\,H^2$, or better, HN^3, or $nC'^m\,H^{m-b}$.

As, by adding to 2 eqs. of water, 1 or more eqs. of carburetted hydrogen, alcohols are formed: as, by adding to 1 eq. of water, 1 or more eqs. of this same carburetted hydrogen, ethers are produced; as, by adding to 4 eqs. of oxygen, 1 or more eqs. of this same carburet of hydrogen, acids are made; so, by adding to 1 eq. of ammonia, 1 or more eqs. of this same carburet of hydrogen, organic alkalis are formed.

At the same time, M. Wurtz enriches science with many new organic alkalies, and with a law which teaches us at once what are the relations of these alkalies to each other, and how we may attach to the series which they open the alkalies already known.

He furnishes to investigation a vast and new field, by shewing what is the most simple and most general mode of generation of the organic alkalies, and by this putting chemistry in a way which will permit it to produce the most complicated and most useful organic alkalies, such as quinine, morphine, &c.

Taking ammonia as a point of departure, M. Wurtz has already obtained, or put in their systematic place, the following alkalis—

Ammonia	NH^3.
Methylia	$NH^3, C^2\,H^2$.
Ethylia	$NH^3, C^4\,H^4$.
Butyria	$NH^3, C^8\,H^8$.
Amylia	$NH^3, C^{10}\,H^{10}$.
Nicotine.....	$NH^3, C^{10}\,H^4$.
Aniline	$NH^3, C^{12}\,H^4$.
Picoline.....	$NH^3, C^{12}\,H^4$.

Toluidine	$NH^3, C^{14} H^6$.
Conicine	$NH^3, C^{16} H^{12}$.
Cumidine	$NH^3, C^{18} H^{10}$.
Leucol	$NH^3, C^{18} H^4$.

The first four of these alkalies were discovered and studied by M. Wurtz. Their analogy with ammonia is truly surprising. That which approximates most to it re-produces all its properties with a fidelity which can be found only in bodies of mineral chemistry; in soda and potassa for example.

Each of them being capable of re-producing all the derivatives to which ammonia gives rise; that is to say, the salts, the amides, the double or complex compounds, so numerous in the ammoniacal combinations, their study will certainly enrich chemistry with an immense number of new species from which the arts will find unknown resources, physiology unforeseen explanations, and chemical theories valuable means of control.

M.M. Thénard, Chevreul, and Dumas conclude their report by stating that M. Wurtz has proved everything he undertook to do to their entire satisfaction.

ON SULPHITE OF PERCHLORIDE OF PHOSPHORUS.*

BY P. KREMERS.

According to Professor Rose, a compound of sulphuric acid and perchloride of phosphorus is formed, when sulphuric acid and protochloride of phosphorus are put in contact, the latter being oxidised at the expense of the sulphuric acid. I have prepared a similar compound with the same elements, put together in a different manner. A current of dry sulphuric acid being passed over perchloride of phosphorus, these two bodies combine, forming, with the evolution of much heat, a greenish liquid. In rectifying it, a portion of the sulphurous acid escapes, and the distillate corresponds in composition to the formula $PCl^5, 2SO^2$†, and has the following composition in 100 parts :—

	The formula $PCl^5, 2SO^2$ gives
$P = 11{\cdot}73$	$11{\cdot}71$
$Cl^5 = 64{\cdot}24$	$64{\cdot}87$
$S^2 = 12{\cdot}23$	$11{\cdot}71$
$O^4 = 11{\cdot}80$	$11{\cdot}71$
$100{\cdot}00$	$100{\cdot}00$

This compound, which is limpid, and highly hygrometric, annoys the eyes and lungs very much, and surpasses in refractive power the sulphuret of carbon, like which, it possesses the power of dissolving iodine, acquiring a red color. Its sp. gr. at 57° is 1·667; its boiling point is 212° F. When poured into water, it subsides in drops to the bottom, like sulphate of perchloride of phosphorus, and is by degrees decomposed into sulphurous, hydrochloric, and phosphoric acids. Sulphuric acid is not formed.

This behavior in contact with water was made available for its analyses, the sulphurous acid being converted by means of chlorate potassa into sulphuric acid. This compound dissolves much perchloride of phosphorus, which, on being set aside at the ordinary temperature, separates, after some time, in the form of translucent square prisms; whilst, according to Davy on fusion, it crystallises in prismatic columns. The mother liquor, after the separation of the crystals, gave analytical results, which also corresponded to the formula $PCl^5, 2SO^2$:—

	The formula $PCl^5\ 2SO^2$ gives
$P = 12{\cdot}12$	$11{\cdot}71$
$Cl^5 = 65{\cdot}48$	$64{\cdot}87$
$S^2 = 11{\cdot}44$	$11{\cdot}71$
$O^4 = 10{\cdot}96$	$11{\cdot}71$

On comparing this last analysis with the first, we find that the calculated formula is nearly a mean of the two. In the first, the sulphur and oxygen; and in the second, the phosphorus and chlorine stand higher than theory indicates; this was because, in the first, some sulphurous acid, and in the second, some perchloride of phosphorus, was retained in solution; at any rate, I found, after repeating the distillation, 0·4 per cent. less sulphur in the first than the sample had previously yielded. Consequently to obtain this compound in a state of purity, it must be distilled a second time.

When a current of sulphurous acid is passed through this compound, it absorbs another equivalent, which, however, is held in such weak combination that it escapes at the ordinary temperature, and more rapidly with the aid of a gentle heat, which renders its analysis rather difficult.

	The formula $PCl^5, 3SO^2$ gives
$P = 10{\cdot}86$	$10{\cdot}48$
$Cl^5 = 59{\cdot}07$	$58{\cdot}08$
$S^3 = 15{\cdot}88$	$15{\cdot}72$
$O^6 = 14{\cdot}19$	$15{\cdot}72$
$100{\cdot}00$	$100{\cdot}00$

It differs from the foregoing in its lower sp. gr. and refractive powers.

* *Annalen der Chemie und Pharmacie*; June, 1849.

† This compound has lately been prepared by M. Persoz.

When ammonia is passed over the sulphite of perchloride of phosphorus, the same phenomena are noticed as when its constituents are treated separately with ammonia. Chloride of ammonium and dry bisulphite of ammonia are produced, and a white powder, which does not differ from that obtained by treating perchloride of phosphorus with ammonia. A preliminary examination of the substance, dried at 212° F., gave only 36·18 per cent. of phosphorus.

RESEARCHES ON THE SPECIFIC PROPERTIES OF THE TWO ACIDS OF WHICH RACEMIC ACID IS COMPOSED.*

BY M. L. PASTEUR.

In the first researches which I had the honor of presenting to the Academy on this subject, and of which it was pleased to signify its approval, I arrived, among other results, at the extraction from paratartaric or racemic acid—which has no action or polarised light—of two acids deviating, one to the right, the other to the left, the plane of polarisation of the rays of light. But I had obtained these acids in such small quantity that the maximum deviation did not exceed one degree. Now, thanks to M. Kestner, the discoverer of racemic acid, who has kindly placed at my disposal a considerable quantity of that acid, I am enabled to submit to the Academy a detailed study of the two acids, and of the salts which they furnish. I attach the greater value to M. Kestner's kindness from the fact, that this singular acid is no longer produced. Not only has he never obtained a trace of it in his manufacture, since his discovery of it, but he has made various attempts to reproduce it without success. This acid has, therefore, been produced only once, doubtless in a peculiar circumstance of the manufacture. The grapes of Vosges do not contain it any more than those of other countries.

In order to present to the mind at once the origin of these two acids, and the opposite direction of the action which they exert on polarised light, I have called them respectively *dextroracemic* and *levoracemic* acid, with no other view than to designate them positively.

I prove beyond dispute that the acid which deviates to the right can, in no respect, be distinguished from tartaric acid. I have studied, comparatively, the dextroracemates, or tartrates, and the levoracemates. Nothing is more novel or more curious than the comparison of the physical and chemical properties of tartaric and levoracemic acids, and of the salts to which they give rise. The following is a brief summary of this memoir:—

I proved, in the memoir which preceded this, that tartaric acid and the tartrates are hemihedral; that is to say, have a crystalline form, which, for the modifications, derogates from Haüy's law of symmetry. I now show that levoracemic acid and the levoracemates have the same crystalline forms as tartaric acid and the tartrates, only the dissymmetry is to the left instead of to the right. Tartaric acid and the tartrates deviate to the right, the plane of the polarisation of light. Levoracemic acid and the levoracemates deviate to the left, in the same degree and following the same laws of dispersion. Beyond these two facts—the dissymmetry of the form and the inverted direction of the rotatory polarisation—it was impossible to find the slightest difference between the tartrates and levoracemates. The same angle of the faces, the same physical aspect, the same solubility, the same specific gravity, the same chemical composition, the same double refraction. All the chemical properties are also the same. If we prepare with tartaric acid any kind of tartrate—neutral salt, acid salt, double salt, or emetic—by operating in the same way with levoracemic acid, a levoracemate is obtained, which cannot be distinguished from the tartrate, except by the direction of the rotatory powers, and by the fact that its crystalline form, although identical with that of the tartrate in all its respective parts, cannot be superposed on it.

I expected to recognise some difference between these two acids in the numerous peculiarities presented by tartaric acid. Thus, assuredly, one of the most curious properties of tartaric acid is its special power of dispersion of the planes of polarisation of the different simple rays, studied in detail by M. Biot. Indeed, I found it without any modification in levoracemic acid. I formed solutions of levoracemic acid of the same strength as certain tartaric solutions studied by M. Biot, and I obtained the same tints for the different azimuths, the same deviation of red rays, the same deviation for the tint of passage.

The proportion of water in the tartaric solution, and the elevation or abatement of temperature, have a very considerable influence on the rotatory power of tartaric acid. This influence is the same for levoracemic acid.

I may, in the last place, relate a curious observation, which shows, in a striking manner, the close correlation of the properties of

* *Comptes Rendus*, No. 12; Sept. 17, 1849.

the two acids. All the tartrates dissolved in water deviate to the right, the plane of polarisation of the luminous rays. The tartrate of lime possesses, on the contrary, the singular property of deviating to the left when it is dissolved in hydrochloric acid. It might be presumed that the levoracemate of lime, dissolved in this acid, would deviate to the right. It is precisely what occurs. Thus, I repeat, beyond the dissymmetry of the form, right in one case and left in the other, and beyond the opposite direction of the rotatory power, I have not been able to find the least difference between the tartrates and levoracemates.

In the study of the correlation of the hemihedron with the phenomenon of the rotatory polarisation, it is necessary to distinguish two species of hemihedron, and to this point I especially call the attention of natural philosophers and geometricians. There is a hemihedron which might be called the superposable hemihedron, of which boracite, Iceland spar, nitrate of soda, &c., present examples. Boracite crystallises in cubes, with four facettes on the angles, which lead to a regular tetrahedron; Iceland spar and nitrate of soda crystallise in rhombohedrons deriving from the hexagonal prism. These are hemihedral substances; but it must be observed that all regular tetrahedrons are superposable, that all the rhombahedrons of the same angle are so likewise. We cannot construct ideally a rhombohedron identical with that of Iceland spar, and which is not superposable on it. We cannot imagine a cube passing to a regular tetrahedron not superposable on that of boracite. I would say as much of a substance which would crystallise in tetrahedrons of the system of the right prism with a four-sided base.

There is a second kind of hemihedron, of which tartaric acid and the tartrates present examples. All these substances are hemihedral, but to each of their crystalline forms corresponds another, identical in all its respective parts, and which cannot, however, be superposed on it. And not only are these forms—which would resemble the first as the left hand resembles the right—possible, they really exist. These are the crystalline forms of levoracemic acid and the levoracemates. As another example of this second kind of hemihedron, which may be called a non-superposable hemihedron, I may mention the two plagihedral varieties of rock crystal. They represent two symmetrical non-superposable polyhedrons, and there is between them the relation which exists between the crystalline form of a tartrate and that of the corresponding levoracemate.

In conclusion, I may add that, so far, we see that where there is a superposable hemihedron, the rotatory power does not exist, and that it exists, on the contrary, in cases where there is a non-superposable hemihedron. Is it always so? This, experiment must decide. I will endeavor to furnish the solution of this question, and of those which are connected in such great number with these new studies, and will hasten to communicate the results to the Academy.

NEW METHOD OF ANALYSING METALLIC SALTS.*

BY M. ROUCHER.

In pursuing some investigations on the composition of the different nitrates of copper, I devised (says M. Roucher) an analytical method which, by reason of its simplicity, its rapidity, its accuracy, and the generality of application of which it is susceptible, has appeared to me worthy of being submitted to the judgment of the Academy.

This method consists in precipitating the insoluble metallic base by a determined volume of an alkaline solution of known strength. The oxide being deposited, the liquor is thrown on a filter, and the oxide is washed until the washing water no longer presents an alkaline re-action with very delicate reddened litmus paper. The alkali, still free after the precipitation, is thus collected into one liquor, which is again tested. The difference between the two tests necessarily corresponds to the quantity of acid which was contained in the salt, and which neutralised a portion of the alkali. This quantity is, moreover, proportional to the quantity of monohydrated sulphuric acid contained in normal acid, indicated by the difference of the two strengths which were determined; it may be deduced from it by a very simple calculation.

ANALYSIS OF THE WATER OF THE DEAD SEA.†

BY M. R. T. MARCHAND.

We are at present acquainted with six analyses of the Dead Sea—those of Lavoisier, Marcet, Klaproth, Gay-Lussac, Hermstaedt, C. G. Gmelin, and, finally, by Dr. Apjohn. The results of these analyses differ from each other, not only as to the quantity of the salts held in solution in this water,

* *Comptes Rendus*, No. 11, Sept. 10, 1848.

† *Annalen der Chemie und Physik*, von J. C. Poggendorf.

but likewise as to the proportions which exist between the different elements. The cause of these variations is, without doubt, to be traced to the difference between the composition of the depths of the sea and the shallows impregnated with salt, which are formed in the south by the mountains of rock salt of Usdum. Some years since, M. de Kunowski brought nearly a quart of water from the Dead Sea, in a sealed bottle, which he had taken from the western extremity of the lake, not far from the mouth of the Jordan. He sent this water to M. Marchand, likewise a small quantity of earth from the Desert of Zeph, situated at the west of the Lake Asphaltites. M. Marchand found the density of this water to be at 66° F., 1·18415, and at 55° F., 1·1859, which is a lower cypher than has been indicated by most observers. The analysis, which was made in the ordinary manner, gave the following results:—

Chloride of calcium	2·894
Chloride of magnesium ..	10·543
Chloride of potassium ..	1·398
Chloride of sodium.....	6·578
Chloride of aluminium ..	0·018
Bromide of magnesium ..	0·2507
Sulphate of lime.....	0·088
Silica	0·003
	21·7727

These figures have, no doubt, reference to 1000 parts of water.

As for the earth, it contained about 16 per cent. of substances soluble in water, amongst which a considerable amount of bromide of magnesium was observed.

ON THE ACTION OF LIGHT ON PRUSSIAN BLUE IN VACUO.*

BY M. CHEVREUL.

In the investigations read to the Academy on the 2nd of June, 1837, on the action of light, steam, oxygen, and dry and humid air, which led me to appreciate the extreme difference existing between the action of light on coloring matter, and the action of light and the air on these same matters, I had an opportunity of proving the remarkable fact that, in the luminous vacuum, the most alterable coloring matters, may be kept for whole years, whilst Prussian blue kept in vacuo, loses its blue color, disengaging cyanogen or hydrocyanic acid. Having ascertained, moreover, that the contact of oxygen gas reproduced exactly the original color of decolored Prussian blue, these observations appeared to me sufficiently interesting to be resumed, with the view of explaining several phenomena which animals and vegetables present during their life, and to make it the subject of a special work, which, after having been read to the Academy, was published in the *Journal des Savants* for Nov., 1837, under the title of *General Considerations and Inductions relative to the Matter of Living Beings*. In devoting myself to these considerations, I had admitted that *the decoloration of Prussian blue is effected in the luminous vacuum by a loss of cyanogen or hydrocyanic acid, and that its re-coloration, under the influence of oxygen, takes place because, for* 9 *atoms of protocyanide of iron, there are* 2 *atoms which, yielding* 4 *atoms of cyanogen to* 4 *atoms of protocyanide, produce* 4 *atoms of deutocyanide, which, with the* 3 *atoms of protocyanide, re-constitute Prussian blue, whilst the* 2 *atoms of decyanised iron have formed* 2 *atoms of peroxide with* 3 *atoms of oxygen gas.* Here I make allowance for the water or its elements which the Prussian blue may contain.

Conformably to this hypothesis, I made a calculation, according to which, after five successive colorations and decolorations, there seemed to be, for 36 atoms of Prussian blue, in round numbers, 99 atoms of peroxide of iron and 8 atoms of Prussian blue. Now, having resumed my experiments, I ascertained that silk and cotton fabrics dyed with Prussian blue, which, during six years, were de-colored and re-colored five times, entirely losing cyanogen in the luminous vacuum, and being re-colored under the influence of oxygen, gave tints of the same depth as they were originally; and, moreover, that these re-colored stuffs, treated by hydrochloric acid, did not yield a sufficiently considerable quantity of peroxide of iron compared with the original ones, for me to regard the foregoing explanation as conformable to experiment.

Owing to this difficulty, my memoir was published leaving undecided the theory of the de-coloration of Prussian blue. I mentioned in the printed memoir that I intended to repeat the experiment, employing Prussian blue applied, not on organic matter, such as cotton or silk, but on porcelain, and placing the matter in a vacuum absolutely free from all vapor of organic origin.

The results of this experiment I now submit to the Academy.

Very pure Prussian blue was applied to the outside of two hollow porcelain cylinders. One of these cylinders, after having received in its interior alcoholised potassa, contained in a small glass tube drawn out at one end, with

* *Comptes Rendus*, No. 12; Sept. 17, 1849.

the drawn-out end bent and open, was introduced into a glass tube from which the air was extracted by means of a pneumatic pump; it was hermetically sealed over a spirit lamp, and the Prussian blue was exposed to the light; the Prussian blue was laid on the porcelain cylinder in such a manner as to form a sort of gradation. The exposure to the sun lasted three years. Decoloration took place. At the expiration of this time, the glass tube was introduced in an upright position into a receiver with a foot in which there was a layer of sulphuric acid for the purpose of drying the inside; to this receiver was adapted a waxed cork perforated with three holes, by means of a U tube filled with pummice moistened with sulphuric acid; the receiver communicated with a retort filled with chlorate of potassa and deutoxide of copper, and the receiver also communicated, at will, by means of a gas tube, with a receiver filled with mercury. Finally, a glass rod, with a blunt end, passing through the third hole of the cork, which might, in descending, break the extremity of the glass tube containing the Prussian blue. In my absence it was proved that the oxygen gas which was disengaged by the tube did not contain nitrogen. The operation was stopped to be resumed next day. It was then that, on going to resume it, I observed that there was produced on the surface of the mercury a pellicle which could be attributed only to some other gas than oxygen. Experiment very soon showed me that this foreign body was chlorine, and I proved that it was disengaged in treating the mixture of chlorate of potassa and deutoxide of copper which had been sent into the retort, although separately they gave none. After this result, I thought it necessary to recommence the experiment, taking the apparatus to pieces, and putting it together this time with a retort filled with peroxide of manganese, and communicating with the tubes containing pummice moistened with sulphuric acid, by means of a tube of potassa.

This time, I tested the purity of the oxygen gas, and ascertained besides, that it contained no steam sensible to phtoroboric gas. It was after this that, by means of the glass rod, I broke the point of the glass tube containing the de-colored Prussian blue. The blue color was immediately restored. I proved, besides, that during the de-coloration cyanogen or hydrocyanic acid was disengaged in considerable quantity, which was absorbed by the potassa of the small glass tube drawn out at one end. Again, after having ascertained that the re-colored Prussian blue was of a slate color, even after six days contact with oxygen, I treated 0·009 grammes of it with hydrochloric acid so diluted as not to fume, comparatively with 0·009 of normal Prussian blue. The re-colored Prussian blue contained peroxide, which it yielded to the hydrochloric acid, whilst the normal Prussian blue contained none. I give to the Academy the results of these comparative experiments, which are extracted from the records of the *Direction de Teintures des Gobelins.*

From these experiments it results:—

1st. That, under the influence of the sun, *in vacuo*, Prussian blue loses its color, parting with cyanogen or hydrocyanic acid.

2nd. That it resumes its blue color instantaneously under the influence of absolutely dry oxygen gas.

3rd. That in this coloration a quantity of peroxide of iron, corresponding to the quantity of iron decyanised is produced, which peroxide may be dissolved in hydrochloric acid.

4th. That it remains to be explained why Prussian blue fixed on cotton and silk may be de-colored, losing cyanogen or hydrocyanic acid, and re-colored under the influence of oxygen, as often as five times, without appearing altered in its color, and without yielding to hydrochloric acid any considerable quantity of peroxide of iron.

BLOOD IN THE MILK OF A COW.*

BY PROF. MARCHAND.

Professor Marchand made an examination of the milk of a cow which, several times after calving, had given milk resembling a brown syrup, but which exhibited no symptoms of disease. He examined the first milk, and afterwards fresh samples every alternate day.

The first milk was blackish brown, and after standing for a long time did not give a white scum. It was so thick that it could hardly be poured from one vessel into another. It had the odor of milk, and a milky, but insipid taste. Sp. gr. at 60° F. 1·0922; that of natural milk being ordinarily 1·02. A microscopic examination exhibited a great number, but not the natural number, of milk globules; and a large number of the clearly developed granular corpuscules peculiar to the colostrum. Many fibrinous bundles and flakes also existed in it, but no blood corpuscules. Analysis proved that this milk contained the constituents of blood besides those of milk. Like blood, it coagulated when heated, and also when spirit was added. The coagulum was exactly like that yielded by blood under the same circumstances. The

* *Journal für Praktische Chémie.*

alcoholic solution contained fat, and a large quantity of sugar. The precipitate formed by alcohol, digested with alcoholised sulphuric acid, furnished a brownish red clear solution, but was itself converted into a grey crumbly mass. The brown solution presented the well-known re-action of the corresponding solution of the coloring matter of blood. Ammonia caused the precipitation of brown flakes, and these flakes furnished a brownish-red powder, which, dried and incinerated, gave 9 per cent. of peroxide of iron. The milk contained 29·24 per cent. of solid matter, which consisted of—

Fatty matter	1·75
Sugar.....	5·14
Casein	2·20
Albumen	15·00
Fibrin	0·20
Hæmatin, &c.	4·95
	29·24
Water	70·76
	100·00

The samples afterwards examined gradually decreased in sp. gr., becoming also clearer, giving a creamy scum when left to repose, and presenting fewer of fibrinous coagula and granular corpuscles. The proportion of albumen also diminished until the 24th day, when the milk assumed normal characters, with the exception that few granular cells still remained. No blood corpuscles were found in any stage of this investigation, although it was evident that the milk contained blood.

ON THE RELATIONS WHICH EXIST BETWEEN THE COMPOSITION AND THE FORM OF CERTAIN ACIDS, ETHERS, AND CERTAIN HOMOLOGOUS BASES.*

BY M. J. NICKLES.

In a Note presented to the Academy in December, 1848, I mentioned certain relations which exist between the composition and the form of the salts of baryta of the series R^nO^2. I showed that these salts are hemimorphous when they contain different quantities of water. It was known, likewise, from the acetate and butyrate of copper, that they can be isomorphous when they are at the same degree of hydratation.

In the work, of which I submit the epitomised results to the Academy, I describe a new metacetate,—metacetate of copper, containing the same quantity of water as the acetate and butyrate of copper, and possessing a form, if not precisely the same, at least very closely resembling it.

I prove that this property of homologous acids of being isomorphous in their combinations is maintained in ethers and homologous bases. My researches were made with crystallised compounds of the same series as the acids mentioned, which compounds differ among themselves only by CH^2.

The two ethers which I examined are the cyanuric ether of alcohol and that of wood spirit, discovered by Wurtz. They resemble each other like the acetate of copper and the metacetate; that is to say, they are paramorphous: one, the cyanic ether of wood spirit occurs in prisms with an hexagonal base; the other ether crystallises in right rhomboidal prisms with six faces; cutting between them under angles of nearly 120°.

The bases examined were methylamine, and ethylamine in their combinations with oxalic acid. It will be remembered that these bases were lately obtained by M. Wurtz, and that their composition may be represented by $NH^3 + CH^2$ or 2 (CH^3).

The oxalates of these bases are isomorphous.

In endeavoring, afterwards, to ascertain, by changing the acid, whether the form of the salt which results would retain something of the preceding form, notwithstanding the change, I ascertained that hydrochlorate of ethylamine is hemimorphous with the oxalate of the same base.

It is evident, then, that in this case, the crystalline form proceeds on a parallel with the composition. The salt loses one of its elements, oxalic acid, which it changes for another—hydrochloric acid; its general character is modified by it, as well as its crystalline system, and still there is retained in its prisms something which shows, in both, one and the same molecular grouping.

This maintenance of grouping, when the salt changes acid, I have been enabled to make evident by the investigation of a sugar of gelatine and some of its salts. Gelatine sugar is presented in two forms, according to its origin: when prepared with gelatine and sulphuric acid it crystallises in right rhomboidal prisms, when formed with hippuric acid it occurs in oblique prisms of 66° 15′, as observed by H. Kopp. The prisms of the first are those noted as ∞P^2, and are only a modification of the prisms of 66° 15′; their angle also is double the number.

These two orders of grouping are met with in the four salts which I have examined, namely, the sulphate, nitrate, oxalate, and hydrochlorate.

The forms of the oxalate and hydrochlo-

* *Comptes Rendus*, No. 13; Sept. 24, 1849.

rate have for a base the sugar of gelatine at the angles of 132°; the nitrate and sulphate have angles approaching 66°, and approximate, consequently, to the form of glycocolle, in oblique and rhomboidal prisms.

From this extremely succinct summary it is clearly perceived that there exists, in organic groupings, a persistence which might be sought, perhaps, in vain in metallic combinations. An alkaloid is seen to be maintained in the crystalline form in all its combinations, whilst it has not hitherto been possible to find a simple relation between a metallic oxide and its different salts.

COMPOSITION OF THE BILE OF THE GOOSE.*

BY T. MARSSON.

THE geese were fed on oats. The average weight of the contents of eight gall bladders were 46·3 grains.

On drying the entire bile in two instances at 212° F., the result given in columns I. and II. were obtained; in the third column gives the result of drying part of a mixture of the contents of eight bladders at 266° F.

	I.	II.	III.
Solid matter ..	20·13	19·40	19·98
Water	79·87	80·60	80·02

By incineration this bile furnished a white ash, fusible at a red heat, and effervescing with acids. It was composed principally of carbonate and phosphate of soda, with a portion of chloride of sodium and phosphate of magnesia. The ash of the three biles above-mentioned amounted, respectively, to 2·04, 1·85, and 2·08, in 100 parts of recent bile.

The proximate constituents of the bile of the goose are:—

Fatty matter and cholesterine	0·36
Mucus	2·56
Pure bile and coloring matter	17·06
Water	80·02
	100·00

The bile of the goose, separated from the fatty matter and the mucus, contained a very large proportion of coloring matter from which it was difficult to free it. The solution in alcohol, dried at 230° F., re-dissolved in absolute alcohol, left a rather considerable quantity of a grayish brown plastic mass, which consisted of some bile and a large amount of coloring matter. After the solution was evaporated, the fatty matter extracted from the residue by ether, and the residue re-dissolved in alcohol, the solution could not be perfectly de-colored by treatment with animal charcoal. Evaporated and dried at 212° F., the pure bile was obtained in the form of a mass, which was easily pulverised and gave a yellow powder. Its solution in water was very acid with a sweet taste, but very bitter after taste: it differed materially from the bile of the ox and the pig in its behavior with re-agents. Neither acetic acid, oxalic acid, nitrate of silver, acetate of lead, nor bichloride of mercury, produced any precipitate, even with the aid of heat or by standing for 24 hours. The chlorides of barium and calcium, and hydrochloric acid instantly produce abundant precipitates, which are white at first, but in shaking the vessel they adhere to its sides in a plastic form. The precipitate, by means of baryta, dissolves by boiling, even when ammonia is added; it separates in cooling. Acetate of lead also causes in fresh bile an abundant precipitate, which does not redissolve in an excess of the re-agent or by boiling. The bile of the goose gives, with sugar and sulphuric acid, the violet color noticed by Pettenkofer.

On dissolving the pure bile in alcohol of 0·833 sp. gr., and adding hydrated ether, a precipitate is produced which, after a long time, gives crystals, the formation of which is dependent on the proportion of water in the liquids. When the solvents are concentrated, the precipitate remains plastic. The ash of the pure bile consisted chiefly of carbonate and sulphate of soda, with traces of sulphate of lime, sulphuric acid, and chlorine. Sulphur was very abundant in this bile. Its behavior with the above-mentioned re-agents, and the crystallisability of the pure bile, which is the soda salt of what may turn out to be a new acid, perhaps nearly allied to Strecker's choleïc-acid, warrant us in giving this the provisional name of chenocholeïc-acid, to distinguish it from the other acids of the bile.

The pure bile, dried at 230° F., has, according to Marsson's analyses, the composition given in column I., and the constituents of the organic matter combined with the soda are set forth in column II.

	I. Pure bile.	II. After deducting the soda.
Carbon	57·19	60·06
Hydrogen	8·39	8·81
Nitrogen.....	3·48	3·66
Sulphur 6·45 6·23 mean	6·34	6.66
Oxygen	19.82	20·81
Soda	4·78	
	100·00	100·00
Ash.....	9·55 9·65	per cent.

* *Archiv. der Pharmacie.*

ON VARIOUS HYDROCARBONS PRODUCED FROM OIL OF SCHIST.*

BY M. E. SAINT-EVRE.

By fractioning the products of the distillation of the oil of commerce, treating them with sulphuric acid, and purifying them by repeated distillations over fused potassa and anhydrous phosphoric acid, I was enabled to isolate the hydrocarbons represented by the atomic formulæ.

	Boiling point.
$C^{72} H^{66}$	527° F. to 536° F.
$C^{64} H^{62}$	491 ,, 500
$C^{62} H^{60}$	419 ,, 428
$C^{36} H^{32}$	269·6 275

THE BEHAVIOR OF THE STRONTIA AND BARYTA SALTS BEFORE THE BLOWPIPE, &c.

BY DR. SHERIDAN MUSPRATT,
Professor of the Liverpool College of Chemistry, &c.

In several of the leading treatises on Chemistry, I observe the following:—"Strontia salts impart a crimson color to flame." The students, in my laboratory, always precede the nascent testing, by an examination in the dry way, with the view of ascertaining the presence of those substances yielding characteristic colors to the flame, sublimates, or unmistakeable reductions, &c. When they received an insoluble salt of strontia, *e. g.* the sulphate†, carbonate, or phosphate, they invariably mistook the base for calcia (lime) *i. e.* they obtained a yellowish-red flame, and a brilliant phosphorescence in the assay. I have lately performed several experiments, in order to collect satisfactory blowpipe reactions with regard to the salts of strontia. I find that only its moist soluble salts impart a fine carmine tinge to flame, an infallible proof of the presence of this earth. Sulphate of strontia, phosphate of strontia, and carbonate of strontia, dry or moist, do not tinge the apex of the flame. Chloride of strontium when dry does not impart the slightest carmine color to the flame of the blowpipe. When it is moistened, however, with a drop of water, and then submitted to the point of the blowpipe flame, the intense crimson hue pervades the whole combustible, which disappears when the water has evaporated. Mr. Noad also states, with regard to baryta, that "before the blowpipe baryta cannot be detected." Does he mean caustic baryta, or the salts of baryta? Caustic baryta imparts a yellowish color to the flame, but the nitrate of baryta gives a most decided greenish-yellow tinge to the whole flame.

Numerous errors creep into volumes on chemistry, subsequent translators never taking the trouble to satisfy themselves as to the truth of certain statements. We find even in Turner's "Chemistry," that, "when sulphurous acid is added to a solution of selenious acid, pure selenium is thrown down." This is not the case. Selenious acid is not decomposed by sulphurous acid, unless the two are heated together. Further, Gerhardt stated, some years ago, and all the first chemists of France believed him, that valerianic acid could be abundantly obtained from indigo, by fusing it with potassa. At the request of my esteemed and honored friend, Baron Liebig, I repeated Gerhardt's lucrative process, and proved, analytically, the groundlessness of his assertion. His valerianic acid turned out to be a *trace* of acetic acid.

I may state, in conclusion, that too little attention has hitherto been paid to the blowpipe; but I am glad to find that it is daily becoming more and more appreciated, for its results are most certain and characteristic. It requires much practice in its use to be enabled to detect some of the metals; but a skilful blowpipist will often detect in a preliminary examination that which might escape him by the nascent method. "The blowpipe has, indeed, been to chemical analysis, all, and more, than the microscope has been to the observer who devotes himself to natural history." Chemists daily springing up should go over, diligently and carefully, old investigations in inorganic, organic, and blowpipe chemistry, instead of venturing into new fields of research. I am convinced that, by so doing, they will be amply rewarded. The chemist who removes one error from science, is as great a benefactor to science as the discoverer of a host of new compounds.

* *Comptes Rendus*, No. 13; Sept. 24, 1849.

† Noad's Chemical Manipulation and Analysis.—"Before the blowpipe sulphate of strontia fuses to an opalescent mass, and colors the outer flame carmine red."

CHEMICAL EXAMINATION OF THE FAT OILS EXTRACTED BY PRESSURE FROM THE SEEDS OF WHITE AND BLACK MUSTARD.*

BY MR. S. DARBY.

The seeds of sinapis nigra and alba contain, as is known, a very considerable quantity of a colorless fat oil, whose chemical nature is almost unknown. J. Fontenelle

* *Annalen der Chemie und Pharmacie.*

obtained, by pressing mustard-seed, one-fifth of its weight of an amber-colored oil, of the density of 0·0202, solidifying below 32° F., soluble in four parts of ether, and in 1,000 parts of alcohol. According to Messrs. Henry and Garot, this oil contains a solid fat, crystallising in pearly bractees, fusible at 248° F., and not saponifiable.

The experiments of Mr. Darby, on the composition of the fat oil of mustard, bring to light the existence of a new fatty acid, which must be ranked by the side of oleïc acid. These two acids belong to the same series.

The oil of white mustard which Mr. Darby used in his experiments was obtained by pressure from the seeds of eruca (sem. erucæ), bruised, and gently heated. This oil is fluid, of an amber color, inodorous, and of a very sweet taste. It does not congeal during the most intense cold of winter; it merely becomes turbid and thick. When it is strongly heated in a tube, it disengages vapors of acroleïn, a proof that it contains glycerine.

To extract erucic acid from it,—this is the name given by the author to the above-mentioned new acid,—it is saponified with soda; the soap dissolved in water, and separated several times with chloride of sodium, is decomposed with dilute hydrochloric acid, and the mixture of fatty acid, washed with warm water, is converted into lead soap by digestion, on a sand-bath, with finely powdered oxide of lead. The plaster thus obtained is exhausted by ether, and the residue decomposed by hydrochloric acid furnishes a solid fatty acid, which may easily be purified by several crystallisations in alcohol: this is erucic acid.

This acid crystallises, from its alcoholic solution, in brilliant needles; it fuses at 93° F. Its composition is represented by the formula $C^{44}\ H^{42}\ O^4$, which was confirmed by the analyses of the erucates of silver $C^{44}\ H^{41}\ O^3$, AgO, of baryta $C^{44}\ H^{41}\ O^3$, BaO, and of lead $C^{44}\ H^{41}\ O^3$, PbO.

It is evident that this acid does not belong to the series of fat acids, containing an equal number of molecules of carbon and hydrogen, and whose general formula is represented by the symbol $n(C^2\ H^2) + O^4$. Like oleïc acid, it contains less hydrogen than the corresponding term in the series of acids $n(C^2\ H^2) + O^4$. This term is for erucic acid, he benic acid of Völker $C^{44}\ H^{44}\ O^4$.

The fat oil of black mustard, obtained by pressure from the seeds of *sinapis nigra*, yielded by saponification two fat acids, searic acid, erucic acid, and a liquid fat acid, of which the author does not know the composition.

ON THE PROTEÏN COMPOUNDS.

Professor Mulder has arrived at the following conclusions, after a prolonged investigation of proteïn:—

1. The albuminous substances hitherto examined may be regarded as a compound of $C^{36}\ H^{28}\ N^4\ O^{10}$, with sulphumid and phosphamid in different proportions.

2. Next to these are the compounds of oxy-proteïn $C^{36}\ H^{28}\ N^4\ O^{11}$, and $C^{36}\ H^{52}\ N^4\ O^{13}$.

3. Sulphur is not an essential constituent of the precipitate produced by acetic acid in a warm solution of albuminous substances in caustic potassa. Its quantity varies, and the form of the sulphur compound is $S^2\ O^2$.

ON A COPPER AMALGAM.*

BY DR. M. PETTENKOFER.

In Paris some dentists use an amalgam of copper with great advantage, to fill the cavities of carious teeth; it is sold in little cakes of about four grammes, costing two francs each. The color is grayish, it is very hard, and adheres so firmly together as to require a powerful stroke of a hammer to break it. It is of a finely granular crystalline texture. The sample I examined consisted of 30 parts of copper and 70 of mercury. When heated to the boiling point of mercury it swells a little, and a few drops of mercury appear on the surface. Being triturated for some time in a mortar and cooled, it is as soft as moist clay. In this state it can be pressed into the smallest cavities. After a few hours it becomes so hard that a sharp-edged piece will engrave upon tin and cut bone. When soft a very liquid amalgam of copper and mercury can be expressed by a powerful pressure between the fingers. The specific gravity in the soft and hard state differs little.

This metallic compound is an interesting example of the effects of crystallisation and amorphism on the properties of bodies. When soft it shows not a trace of crystallisation. It can be spread with a knife like plaster, but when hard it is very brittle; thin layers break like glass, and the fracture is granular crystalline. Among metals, this copper amalgam is the first known example of two states of a body at the same temperature; and is as instructive as the elastic amorphous sulphur and the brittle stick sulphur amongst the metalloids. It is a most valuable property for the purposes of the dentist, that the specific gravity should not

* *Annalen der Chemie und Pharmacie*, June, 1849.

vary in the transition from the amorphous into the crystalline state, as the mass when hard occupies exactly the same space as when soft. I have pressed the soft amalgam into glass tubes, and when cold it formed a perfectly air-tight stopper.

I have prepared amalgams containing between 25 and 33 per cent. of copper; all became crystalline after heating: those containing most copper solidified more quickly, and became much harder than those containing less. Alloys of 25 parts copper and 75 mercury required three days to become completely crystalline. There is no atomic proportion between the copper and mercury in these crystalline compounds any more than between the constituents of other metallic alloys. A combination of 1 equivalent copper with 1 equivalent mercury would require in 100 parts 23·8 copper and 76·2 mercury. Perfectly analogous compounds occur in the native silver crystalline amalgams; by analysis their amount of silver varies between 25 and 86 per cent. Two metals crystallising together proves them to be isomorphous. This is the case with copper, silver, gold, and mercury.

This copper amalgam is likewise an interesting example of the transference of the state of aggregation from one body to another; the liquid mercury, with the solid copper, passes into a firm crystalline state, which it can only assume at a very low temperature, if alone; as many solid salts become liquid by contact with water.

Having tried several plans I found the following the best:—A weighed quantity of mercury is dissolved in boiling sulphuric acid, and the resulting crystalline paste of protoxide and peroxide of mercury, triturated with finely-divided metallic copper in a mortar with water, at 140° to 158° F., for some length of time. There must be sufficient copper, 1st, to reduce all the mercury; and, 2nd, that enough copper may amalgamate with the mercury. Copper obtained by reducing the oxide in hydrogen is the best, but that precipitated by iron from sulphate of copper will do. The plastic mass, well washed, is put into a leather bag, and as much mercury as possible is pressed out; it is then formed into little cakes, and in a few hours hardens to a mass, the fracture of which resembles in appearance the brittle alloy of lead and gold.

This amalgam is useful to stop machines and chemical apparatus, where cork, glass, &c., cannot be used; it will, probably, likewise, be of service to artists and surgeons.

[An editorial note states that this amalgam may be made with ease by moistening finely-divided copper, precipitated from a solution of sulphate of iron, with protonitrate of mercury, in a porcelain mortar, pouring on it boiling water and metallic mercury, and triturating it for some time. The at first brittle mass soon becomes soft, and when the right quantity of mercury has been incorporated, acquires the desired salve-like consistence.]

ON A NEW METHOD OF DETERMINING THE ORGANIC MATTER IN WATER.*

BY PROFESSOR FORCHAMMER.

The test which he applies is hypermanganesiate of potassa or soda—which he prepares in this way. He heats the hydrate of potassa or soda with chlorate of potassa and the peroxide of manganese, according to the method of Wöhler. After heating, the salt is thrown into water, and so much diluted muriatic acid is added that it assumes a blueish-red color, upon which carbonic acid gas is let through, until the color becomes a bright red, and the manganesiate of potassa completely converted into hypermanganesiate. The liquid must be cleared, either by allowing it to deposit all the oxide of manganese, or by filtering it through asbestos. This liquid may be kept for a very long time unaltered in a glass vessel, with a glass stopper. The next process is to ascertain the strength of the test, which is done by taking any determined measure of it, mixing it with water and a little alcohol, and then heating it. All the manganese is thrown down, and after being washed and exposed to a strong red heat, it is the compound oxide of manganese, $3\,Mn + 4O$. This test is now applied in such a way that, for instance, one pound of the water that is to be tried is mixed with a small quantity of the test, and boiled. If the color have disappeared, another quantity is added, and the liquor again boiled, until in going on in that way, the red color of the liquid does not disappear any longer. After that, it is allowed to cool, and then the quantity of hypermanganesiate of potassa, which has not been decomposed for want of organic matter in the water, is determined by comparing its color with distilled water; to which have been added very small quantities of the test solution. If the quantity of the test which is thus added in excess be subtracted from the whole quantity used, the real quantity of decomposed hypermanganesic acid is determined, and thus, also, the quantity of organic matter itself. This method is liable to one fault—viz., that the nature of the

* British Association.

organic matter may be different, and, accordingly, require different quantities of the test liquor to be decomposed. But the organic matter which generally occurs in water approximates almost always to humic acid, and thus the determination of the organic matter allows it to be compared. As to that part of the organic matter in water which contains nitrogen, the author thinks that he has found out a method for determining it by itself; but not having yet finished his experiments on that point, he must leave it out of the question. Water taken from a green sand-spring, about twelve miles from Copenhagen, contained so little organic matter, that one pound required only six measures of a test solution, of of which 100 measures contained the manganese of 0·526 of the double oxide of manganese; while water taken from a lake which communicates with a peat moss, required for 1lb., 74 measures of the same liquor.

Professor Forchammer, in continuing for a whole year every week this analysis of the water which is used for supplying Copenhagen, observed the following facts:—1st. The quantity of organic matter is greatest in summer. 2nd. It disappears for the most part as soon as the water freezes. 3rd. Its quantity is diminished by rain. 4th. Its quantity is diminished if the water has to run a long way in open channels.

Mr. West asked if all organic substances were oxidised by the salt in question. Professor Forchammer replied, that nitrogenous organic matters occasioned a precipitate by chloride of gold, which precipitate, on analysing according to the ordinary method, gave ammonia. But whether or not all the nitrogen were thus thrown down he had not yet determined. Some further discussion ensued, in which Professor Faraday, Professor Rogers, and Dr. Daubeny took part.

ANALYSIS OF PLANTS BY INCINERATION.*

BY M. CAILLAT.

M. CAILLAT, Professor at the Agricultural Institute of Grignon, thinking that incineration, usually employed to obtain the organic matters of plants, yields incorrect results, and that a large proportion of the sulphur escapes among the gaseous products of combustion, has treated the residues of plants, such as lucern, &c., with dilute nitric acid, and succeeded in separating almost the whole of the mineral substances contained in them; a pulpy residue of 10 grammes, after washing and drying, having burnt readily, leaving only about 18 milligrammes of ashes, consisting of silica and a little peroxide of iron, both insoluble in the acid used. He has always thus obtained a larger proportion of mineral substances from plants than by incineration, and in some vegetables he found much more sulphuric acid than has hitherto been stated.

Experiment proves that incineration decomposes a part of the sulphate of lime; this causes a loss of the sulphuric acid. Thus, on mixing a known quantity of sulphate of lime with starch and water, and incinerating the mass, the ashes did not contain as much sulphuric acid as the sulphate of lime.

Another experiment proves that sulphate of lime, converted into sulphuret of calcium by the influence of inorganic matter, is partly converted into carbonate of lime by the oxygen of the air, which, burning at once the sulphur of the sulphuret and some carbon, forms sulphurous acid, which is evolved, and carbonic acid, part of which remains combined with the lime, aiding thereby the displacement of the sulphur.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

THE PEAT BOGS OF IRELAND.—PRODUCTION OF LIGHTING GAS AND COKE FROM THE DENSER VARIETY OF PEAT.

BY CHARLES WATT, JUN.

CONSIDERABLE attention having lately been attracted to the Irish peat, and a variety of contradictory statements being before the public, as I have had considerable opportunities of seeing it, and of becoming acquainted with it as it really is, a few observations may not be unacceptable to the readers of "THE CHEMIST."

I would premise these observations by calling attention to the fact (and this in some measure accounts for the irreconcileable statements alluded to) that the Irish peat varies very considerably in its physical characters and component parts, owing, partly to its position as regards the surface, and partly to the locality of the bog.

* *L'Institut*, Août 8.

While some of the Irish peat bears a strong resemblance in texture to that which we see in some rural districts of England, there is some which is nearly as dense and dry as coal, and will admit of polishing. This last kind is generally found deeper down, or under the other peat, and has, consequently, been subjected to its pressure for some considerable length of time.

It will naturally be asked, why, when there is peat possessing the characters mentioned, and capable of being advantageously substituted for coal, the Irish markets are not supplied with it in preference to that turf peat which we ordinarily observe, which produces much less body of fire when used as fuel, is much more rapidly consumed, and leaves more earthy matter after its combustion.

The fact is, the peat bogs of Ireland are at present under very bad management in every respect. The contract for the carriage of the peat to the Dublin market, which is by water, being made, as I am informed, by measurement, the carriers have no inducement to convey the denser kind, which would increase the weight of the load without producing any more profit to them than the same bulk of the lighter sort; added to this, the Irish peasantry, who are not gifted with much saving knowledge, find that the less dense turf ignites more readily, and as many of them have not the luxury of a stove, they cannot command sufficient draught to burn a dense fuel.

If a proper separation of these two very different kinds of the same article were made, and if the carriers were encouraged to bring them both to the market, each would find a class of consumers, and much disappointment would be saved to those who desire to use peat as a substitute for coal in manufacturing operations.

In a course of experiments instituted some months since, for the purpose of determining the uses to which the dense variety of the Irish peat could be applied, I subjected a portion to destructive distillation, and obtained as the principal products:—

1st. A gas equal in every respect to oil gas, quite without the peculiar smell of that produced from coal, and free from any compounds of sulphur.

2nd. A carbonaceous residue, differing from both coke and charcoal, possessing some of the properties of each. In density, this form of carbon nearly resembles ordinary coke, while it differs from it in burning much more freely; indeed, a piece of it when ignited will frequently burn itself out.

As regards the other products which peat yields by destructive distillation, although their collection might prove a source of profit, my observations lead me to the conclusion that they will not prove very important items. A portion of ammonia is formed, but the quantity is not so large as in the distillation of coal.

From the foregoing observations, it is quite clear that the peat bogs of Ireland might be turned to very considerable account in that country; gas might be obtained from it for the illumination of the towns, and the coke, if properly prepared, would, I have no doubt, be found to answer for locomotives, and thus one great drawback to Irish railways, the expense of procuring coal from England, would be removed, while the gas would supply that which is at present a great deficiency to the small towns along the railway lines, and at a trifling cost.

There is a variety of purposes to which carbonaceous matter, having the properties of that derived from the peat described, might be advantageously applied, such as some of the metallurgic operations, as a deoxidising agent, freedom from sulphur being essential, while the use of wood charcoal is impracticable from its expensiveness and bulk.

It is much to be lamented that there is such a want of enterprise among that class of our Irish fellow-countrymen, which should be the employing class; to so great an extent is this the case, that I will venture to affirm that it would be next to impossible to induce any of them even to investigate this matter, for the purpose of ascertaining whether or not a sufficient supply of gas could be obtained from their own peat and coke for their locomotives, although the inquiry would cost but little; however, as this is a matter affecting the railway companies of Ireland, it is to be hoped that they will turn their attention to it.

There are few who, if it should ever fall to their lot to examine the peat bogs of Ire,andI will not marvel why Ireland has been so long dependent upon England for fuel, and at the fact that manufactures have not been more cultivated to employ the great mass of laboring power possessed by that country, where the requisite fuel lies almost upon the surface, and, consequently requires but little capital for working; however, the time has arrived when public attention is being drawn to its capabilities, and the rest will, doubtless, follow.

It is a shocking thing to see so fine a country—one whose noble mountains rear their heads so high, and inhabited by beings capable of drawing forth its latent treasures, and thus supplying their own wants, as well as those of their offspring, for want of a little directive energy and capital, so debased as to be a bye-word among nations, when nature has made it an ornament to the world.

ON FIRES, AND THE MODES OF ARRESTING THEIR RAVAGES.

THE occurrence, in London, within the last three weeks, of one of those fearful fires, which occasionally cause an enormous destruction of property in our large towns, calls attention forcibly to the enquiry whether the present means of controlling and extinguishing them are the most effectual that can be devised.

The almost instantaneous ignition of nearly 4,000 bales of wool of course produced an intense body of flame, which at once took effect on the whole construction of the building. When a country mansion takes fire, an express is sent off to the nearest town for the fire-engine; but it almost invariably happens that before the engine arrives the flame has acquired such power as to be uncontrollable. When the engines have arrived, the chief good they can effect is to prevent the destruction of the neighboring buildings. Throwing a large quantity of water on a great body of flame frequently does more harm than good; for the water becomes converted into steam with such rapidity as to blow up the floors and roofs, and thus give greater draught and more food to the raging flame; or, if there are iron pillars and girders, as in many warehouses, the instant a jet of cold water strikes on the heated iron, they snap like glass and fall, and the same effect follows as in the former case. In the great fire at Hamburgh, in 1842,* it was, doubtless, some circumstances of these kinds, causing an unnatural local increase in the fire, that gave rise to a marvellous report on the morning of the third day that the English had heard of the fire, and had sent over by an express vessel the great floating fire-engine, and were pumping oil on the burning town to ensure its destruction.

There are many combinations of chemical substances which would take effect to extinguish flame much more rapidly than water can—*e. g.*, if the fire-engines had a box attached, containing chloride of calcium; and if the supply of water were drawn through this box, the effect of the solution would be very rapid and certain. Any plan, however, which requires a supply of water, is objectionable for the extinction of a great fire.

At the fire of Hamburgh, before alluded to, the immense heat caused such a great rarefaction of the atmosphere that the influx of the surrounding air gave the semblance in the town of a furious gale during the prevalence of the fire; whilst, in fact, at a distance from the town, the air was nearly calm. The same effect takes place with every fire. Combustion requires an accession of pure air for its sustenance, and is, at the same time, in these cases, a self-supplier of the article by strong induction. Any plan which would counteract or effect this peculiarity of a burning building would be much more effective than a simple extinguisher as water. There is a simple machine, invented by Mr. Phillips, which attains this object, and which he calls a fire annihilator. A tin cylinder, about two feet in height and eight inches in diameter, contains a shallow compartment at the bottom filled with water; two smaller cylinders, the sides of which are perforated, are fitted into it, and in the interior one is placed a black brick about nine inches long, and four inches square, composed of charcoal, nitre, and gypsum, and in the centre of the upper end of the brick, is a hole, in which a small phial, hermetically sealed, is placed; this phial has two compartments,—the lower one of which contains chloride of potash and sugar, and the upper one sulphuric acid: a cover is placed over the whole, and has a small plug passing through it, directly over the phial. A sudden blow on the plug breaks the phial, and ignites the brick, which gives off carbonaceous and nitrous gases; while the sudden heat converts the water rapidly into steam, and the gas and steam issue together through a spout in the cover of the cylinder. The instantaneous effect of this gas and steam pouring into a blazing fire, in the

* This fire broke out about two a.m. on Thursday, May 5th, 1842, and its progress was not arrested until about eight a.m. on Sunday, May 8th, notwithstanding a liberal use of water and gunpowder.

place of air, is marvellous at first sight; and it is noticeable that the atmosphere is immediately made harmless to human life.

There can be no doubt to those who have witnessed the effect, that if a large machine, or three or four of the size above-mentioned, had been brought to that recent fire in London-wall, no loss would have occurred beyond the partial destruction of the wool, which seemed to ignite almost simultaneously over the whole gigantic store.

J. N. W.

INQUIRIES CONCERNING SOME MODIFICATIONS IN THE COLORING OF GLASS BY METALLIC OXIDES.*

BY M. G. BONTEMPS.

In this communication some important practical points connected with the colored ornamenting of glass and porcelain were brought forward. In the first place it was shown that all the colors of the prismatic spectrum might be given to glass by the use of the oxide of iron in varying proportions, and by the agency of different degrees of heat; the conclusion of the author being that all the colors are produced in their natural arrangement in proportion as you increase the temperature. Similar phenomena were observed with the oxide of manganese. Manganese is employed to give a pink or purple tint to glass, and also to neutralise the slight green given by iron and carbon to glass in its manufacture. If the glass colored by manganese remains too long in the melting pot or the annealing kiln, the *purple* tint turns first to a light *brownish red*, then to *yellow*, and afterwards to *green*. White glass, in which a small proportion of manganese has been used, is liable to become light yellow by exposure to luminous power. This oxide is also in certain window glass disposed to turn pink or purple under the action of the sun's rays. M. Bontemps has found that similar changes take place in the annealing oven. He has determined, by experiments made by him on polygonal lenses for M. Fresnel, that light is the agent producing the change mentioned; and the author expresses a doubt whether any change in the oxidation of the metal will explain the photogenic effect. A series of chromatic changes of a similar character were observed with the oxides of copper, the colors being in like manner regulated by the heat to which the glass was exposed. It was found that silver, though with less intensity, exhibited the same phenomena; and gold, although usually employed for the purpose of imparting varieties of red, was found, by varying degrees of heat at a high temperature, and recasting several times to give a great many tints, varying from blue to pink, red, opaque yellow, and green. Charcoal in excess in a mixture of silica-alkaline glass gives a yellow color, which is not so bright as the yellow from silver; and this yellow color may be turned to a dark red by a second fire. The author is disposed to refer these chromatic changes to some modifications of the composing particles rather than to any chemical changes in the materials employed.

Dr. Faraday spoke on the importance in all our inquiries of associating physical and chemical science. In the beautiful facts brought forward by M. Bontemps, it appeared that many of the changes of color mentioned are purely physical. The phenomena of the change of manganese from white to pink in glass appeared to him inexplicable as a chemical effect. Mr. Dilke inquired upon what peculiarity depended the differences discovered to exist in the colored glass of the windows of old churches and that of modern manufacture? M. Bontemps stated that the differences observed were entirely due to age and imperfections in manufacture. Dr. Faraday remarked that any irregularities tended to produce the diffusion of the rays which permeate the glass, and that the opacity of ancient church windows was probably due to a superficial change of the external surface. M. Bontemps stated that old glass was, by re-polishing, rendered as transparent as any modern glass.

* British Association.

RESEARCHES ON THE THEORY OF THE PRINCIPAL PHENOMENA OF PHOTOGRAPHY IN THE DAGUERREOTYPE PROCESS.*

BY A. CLAUDET.

The various subjects treated by M. Claudet were the following:—1. What is the action of light on the sensitive coating? 2. How does the mercurial vapor produce the Daguerreotype image? 3. Which are the particular rays of light that impart to the chemical surface the affinity for mercury? 4. What is the cause of the difference in achromatic lenses between the visual and photogenic foci? Why do they constantly

* British Association.

vary? 5. What are the means of measuring the photogenic rays, and of finding the true focus at which they produce the image? Light produces two different effects on the Daguerreotype plate capable of giving an image. By one the surface is decomposed, and the silver is precipitated as a white powder: this action is very slow. By the other the parts affected by light receive an affinity for the mercurial vapor, and this metal is deposited in white crystals: this action, which is the cause of the Daguerreotype image, is 3,000 times more rapid than that producing the decomposition of the surface. After having examined the phenomena of these two actions, M. Claudet considers that it is impossible to refer them to the same cause. The first is a chemical decomposition of the surface, and the second is a mere new property imparted to the surface to attract the vapor of mercury, which is given by some particular rays and withdrawn by some other rays. The most refrangible rays produce the affinity for mercury, and the less refrangible withdraw it. M. Claudet afterwards explained the principle of his photographometer, and several improvements he has lately made in that instrument, by which h e can compose upon the same plate a series of intensities in a geometrical progression, varying from 1 to 512, and when employing two plates at the same moment, from 1 to 8,192; and by another modification of the instrument, by shutting one-half of every hole through which the light has affected the plate, and submitting this half to radiation through red, orange, or yellow glasses, he can study the modifications produced on the various intensities of effect by their colored or insulated radiation. The experiments to which M. Claudet refers would be too long to enumerate here, and we shall conclude by alluding to the most important point of this paper, which is the question of the difference between the visual and photogenic foci, and the constant variations they undergo by the influence of unknown causes—at all events, which he has not been able to ascertain. It is known that several years ago M. Claudet was the first to point out the difference between the two foci, and the necessity for the operator to place the plate exactly at the point where the photogenic focus is produced in order to have a correct daguerreotype image; but the new important fact lately observed by M. Claudet refers to the frequent variation between the proportionate distance of these two foci. It appears that, according to some causes which M. Claudet has not yet been able to discover, the two foci for the same distance of an object are sometimes coinciding and sometimes very far from each other; and what is most remarkable is, that the difference varies according to some properties of the lenses in such a manner that, when the two foci coincide in some lenses, they may be very much separated in others.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

Improvements in Bleaching Cotton. Pierre Isidore David, of Paris. Sealed Feb. 28th, 1849.

These improvements consist in a mode of bleaching cotton by means of chlorine. Oxide of manganese and hydrochloric acid are put into a retort, on a sand-bath; the gas generated is conveyed, by means of tubes, through a series of glass vessels, in which it is washed and purified; a pipe, leading from the last of the glass vessels, conveys the gas into the bottom of a wooden chamber. The substance to be bleached—either cotton in its raw state or spun or woven into goods—is laid upon a perforated leaden shelf, or partition, of the box; the gas is thus made to pass up through the cotton, or goods, and thus bleaches them.

A fan, or blowing machine, is sometimes used for facilitating the passage of the chlorine, and, likewise, to clear the chamber of gas, before opening it to take out the bleached articles. The chamber is provided with glass-covered openings, in order that the operation may be watched.

Improvements in the Treatment of certain Mineral Waters to obtain Product therefrom, and in obtaining certain Metals from certain Compounds containing those Metals, and in obtaining other Products by the use of certain Compounds containing Metals. Thomas Rowlandson, of Liverpool. Sealed 28th Feb., 1849.

The first improvement consists in precipitating copper from its solutions by means of alkaline, earthy, or metallic sulphates, giving the preference to such sulphates as throw down the metallic copper alone, without other metallic or earthy precipitates. The second improvement consists in the treatment of ores containing copper, silver, and gold, either singly or combined, and, at the same time combined with zinc. The zinc prevents the ores from being treated in the usual manner for reducing the other metals. The patentee roasts such ores in the first instance (after reducing them to

powder), maintaining them for some time at a red heat, by which the zinc is converted into sulphate and oxide of zinc, the former of which is separated by lixiviation, the latter by means of sulphuric or hydrochloric acid. The third improvement is in forming stannates of soda and potassa by roasting tin ores with carbonate of soda or carbonate of potassa in a furnace; the mixture is kept stirred.

The other improvements relate to the production of sulphate of soda. The patentee claims :—

1. The precipitation of copper from mineral waters, or solutions containing copper by means of alkaline, earthy, or metallic sulphates.

2. The means of treating and separating zinc from ores of lead, copper, silver, and gold.

3. The formation of the stannates of soda and potassa, by treating ores of tin, or other matters containing tin, with carbonates of soda and potassa.

4. The production of sulphate of soda by treating bisulphate of iron and iron with common salt.

5. The obtaining sulphate of soda by treating bisulphate of iron and subsulphate of iron with common salt.

Improvements in the Manufacture of Oxide of Zinc, and in the Making of Paints and Cements where Oxide of Zinc is used. C. A. F. Rochaz, London. Sealed 28th Feb., 1849.

The first improvement has for its object to produce a greater quantity of pure oxide from a given quantity of zinc than has hitherto been obtainable. The means employed for this purpose are, subliming the zinc, the oxide of which is collected in chambers, in which are suspended ranges of bands, to which the pure particles of zinc adhere, and from which they are removed from time to time as they collect. Mr. Rochaz prefers making the external covering of the chambers, for collecting this oxide, of canvas, which is wetted and found advantageous. The oxide which adheres to the canvas, is removed by beating on the outside.

The second consists in employing the coarser portions of oxide, which are scraped from the passages and other parts of the apparatus, mixed with lime, as mortar. This forms a very hard and durable cement.

He makes a durable and quick-drying white paint by taking 20 parts of oxide of zinc, 4 parts of resin, 2 of turpentine, and 1 of drying oil.

Improvements in the Manufacture of Glass, and in the Preparation of certain materials to be used therein; parts of which improvements are also applicable to the Manufacture of Alkalies. W. H. Balmain and E. A. Parnell, St. Helen's, Manufacturing Chemists. Sealed March 5th, 1849.

These improvements consist in the mixture and preparation of materials for the manufacture of glass.

One mode consists in heating the sulphate of soda, potassa, or baryta with sand and carbonaceous matter, and maintaining the whole at a degree of heat which shall cause them to combine and form the silicates of the different bases.

The chief feature of the other mixtures is the use of deoxidising agents, so that the sulphates may be used in the manufacture of glass. The sulphates do not act destructively on the pot, and are much cheaper than the carbonates.

Another improvement consists in the use of a furnace of a particular description for alkalies and silicates. The raw material is thrown on an inclined bed at the further end of the furnace, and, as it melts, runs down to the bottom of the incline, where there is an opening, through which it flows into moulds, or into a vessel containing water.

Improvements in Smelting Copper Ores. Francis Hay Thomson, M.D. Sealed 14th March, 1849.

This invention relates to an improvement in the smelting of copper ones, by the use of an improved flux, which consists of a peculiar kind of stone, commonly known as whinstone, mixed with carbon, and with or without other materials; other stones, of the same nature as whinstone, may be employed, such as crap, basalt, seynite, &c., forming fusible silicates as a flux in the smelting of copper ones, whether such ores are in the state of sulphuret, carbonate, or oxide. In the case of sulphuret of copper, containing 20 per cent. of copper, or upwards—say, in smelting one ton (which, after being calcined in the ordinary manner, is placed in an ordinary reverberatory furnace) as a flux for that quantity of ore, Dr. Thomson employs 4 cwt. of whinstone, or other stone mentioned, broken into small pieces, and mixed with 70 lbs. of powdered coke, or other kind of carbon, such as charcoal or anthracite coal.

As a further improvement, he adds to the materials of the flux 37 pounds of barilla, in which case, half of the whinstone, or other stone, may be dispensed with, only 2 cwt. being used for the ton of ore, which will effect the desired object.

With regard to the smelting of carbonate or oxide of copper ore, the same quantity of whinstone is employed, with the coke added to it; but with the addition of 56 lbs. of limestone, and 20 lbs. of oxide of iron, which are required to produce the improved result, and employed as a flux in the smelting of these ores, supposing the quantities of the first-mentioned to be the same as in the previous example. Other matters may be used instead of the oxide of iron, such as calcined black-band iron-stone, or carbonate of iron, as well as compounds of other matters, whose chemical properties are such as to produce the like effects, and which it would be an endless task to enumerate—as well as substitutes for several other matters mentioned, as, for barilla, common kelp may be used. Iron slag, which is easily obtained in any quantity, is also applicable, according to this invention. The patentee claims the smelting of copper ores by the use of whinstone, or other similar stone, broken into small pieces, or by the employment of iron slag, all of which must have carbon added, with or without an alkali.

Improvements in Coating or Covering Metallic and Non-Metallic Bodies. P. A. Fontainemereau (Communication from a foreigner). Sealed 14th March, 1849.

The patentee specifies a great number of new solutions of metals, which may be used for depositing on other metals, by means of the galvanic battery. We select some of these:—

For Gilding.—Take one part of chloride of gold and precipitate, with a soap made of gayac pitch; then dissolve the precipitate in 100 parts of hot water, to which has been added 10 parts of caustic potassa, or its equivalent of caustic soda.

Another.—Take one part of oxide or chloride of gold; dissolve in 200 parts of hot water, with 20 parts of caustic potassa, or its equivalent of caustic soda, to which let 15 parts of sulphate of potassa or soda be added, to render the fluid more capable of conducting the electric current.

For Platinising.—A solution of bichromate of platinum and potassium is employed.

For Silvering.—Employ a solution of the carbonate of silver and carbonate of ammonia.

Improvements in Coating Iron and certain other Metals and Alloys of Metals. T. H. Russell, of Wednesbury, and J. S. Woolrich, of Birmingham. Sealed 19th March, 1849.

Messrs. Russell and Woolrich's improvements consist, firstly, in coating iron with cadmium, either with the aid of electricity or by immersion in a hot bath of the metal.

When the coating is to be effected by means of electricity, a precipitate of cadmium is first obtained, which is re-dissolved in a solution of cyanate of potassa. The articles to be coated are immersed in the solution, and treated in the manner usually practised for coating metals by means of the galvanic battery. The positive wire should terminate in a plate of cadmium, and that should surround or be placed at a few inches from the surfaces to be covered.

When the articles are to be coated by immersion in the molten metal, a portion of tin is to be added to the cadmium. The articles are cleaned by dipping in dilute acid, and then plunged into the fused metal, and left in for some time; the surfaces will then become covered. The surface of the melted metal is kept covered with oil or tallow, to prevent oxidation.

Articles made of iron, such as screw propellers, &c., may be protected by being partially covered with cadmium.

The second part of the invention consists in certain methods of coating metals with copper, by means of the soluble acetates, benzoates and cyanates of potassa.

Improvements in Recovering useful Products from the Water used in Washing and in Treating Wool, Woollen Cotton, and Cotton Fabrics, and other Fabrics. Alexander McDougall, Longsight, near Manchester. Sealed 19th March, 1849.

The specification is confined to the description of the mode of "recovering useful products from the water used in washing," which consists in precipitating the soap in the water by means of the muriate of lime [chloride of calcium], separating the water, and treating the precipitated lime soap with hydrochloric acid. The chloride of calcium thus formed may be used over again.

Improvements in the Deposition and Manufacture of certain Metals and Alloys of Metals, and Improved Mode of Treating and Working certain Metals and Alloys of Metals, and in the Application of the same to various Useful Purposes. A. Parkes, Harborne, Staffordshire, chemist. Sealed March 26th, 1849.

These improvements consist:—

1. In depositing on the surface of iron tubes, or any other articles of metal, copper, silver, tin, lead, and bismuth, in successive layers, by means of electricity. He states that he has found metallic articles to be much better protected in this way than by the old system of depositing only one metal.

2. In driving air or chlorine gas, by means of a blowing machine, over the surface of

copper, or the alloys of copper, in the refining furnace, to facilitate the smelting process.

3. In forcing air, by means of a blowing machine, upon sulphuret of copper in the blast or reverberatory furnace, in the manner specified in a former patent granted to Mr. Parkes.

4. In the application, as a blowing machine, for the two foregoing purposes, of the apparatus commonly employed to exhaust gas from retorts.

5. In combining iron, silver, and nickel, for casting, with phosphorus, in the proportions of from two to ten, by dropping the phosphorus into the combined metals when in fusion.

6. In coating metals, or metallic alloys, with a combination of other metals, or alloys of them, which melt at a lower temperature than the former.

7. In coating rollers, which have been worn by use, with the phosphuretted metal.

8. In combining with copper or its alloys, molyodenum, chromium, tungsten, and manganese, which are to be used in the form of acid oxide. The metals are placed in a crucible, covered with carbon, and a small portion of phosphorus is mixed with them.

9. Mr. Parkes suggests the manufacture of printing rollers, by coating cylinders of iron or other metal with copper. A solution of copper in cyanide of potassium, at 150° F., is used for this purpose.

Improvements in the Manufacture of Gases, and in the application thereof to the purposes of heating and consuming smoke; also, improvements in furnaces for economising heat, and in apparatus for the consumption of gas. STEPHEN WHITE, Manchester, engineer. Sealed March 26, 1849.

This invention relates principally to the construction and arrangement of apparatus for the production of what is termed water gas, and which was the subject of a former patent granted to Mr. White. This gas is composed of a combination of carburetted hydrogen gas, with hydrogen gas and oxide of carbon gas, the result of the decomposition of water by contact with charcoal, coke, or anthracite coal, mixed with small particles of iron or lime, heated to a high temperature.

The apparatus first specified is constructed of a material capable of bearing the greatest heat that can be obtained (white red), and consists of two vertical retorts, placed in an oven over a furnace. Inside each retort there is a flue which communicates at bottom with the furnace, and at top with the oven. The products of combustion ascend the flues, and pass into the oven, so that the retorts and their contents are heated both inside and outside. They are filled with small pieces of charcoal, coke, or anthracite coal, and thin plates of iron or pieces of thin iron wire, and thin covers at top, by which these materials are introduced, luted and securely fastened down, so as to render them perfectly gas-tight. Water is caused to fall in a succession of drops, or in a small stream, into syphon pipes, which conduct it in to the top of the materials through which the gas thus generated descends to the bottom of the retorts, whence it escapes into horizontal retorts (likewise placed in the oven), and there meets and mingles with carburetted hydrogen gas, which is generated as follows:—A quantity of resin and oil, or of tar and fat, or other substance rich in carbon and olefiant oil, is melted in a vessel fixed on the top of the oven, and allowed to flow in a liquid state into the horizontal retorts, which are each divided into two or more compartments by horizontal partitions extending nearly to the end. These compartments are filled with copper or iron chains, or pieces of wire twisted into a spiral form, so as to offer a heated and partial resistance to the passage of the gas to the hydraulic main. When pit coal is used instead of resin as the hydro-carbon, it is placed in the horizontal retorts, and the employment of the other parts of this branch of the apparatus dispensed with, care being taken to allow sufficient passage for the gas resulting from the decomposition of water, to mix with the carburetted hydrogen gas produced by the distillation of coal.

The chains are to be occasionally taken out of the horizontal retorts, for the purpose of freeing them from the carbon which may adhere to them.

The proportion of iron to coke in the vertical retorts should be as 1 : 6, and the quantity of materials in the vertical and horizontal retorts should be so regulated with regard to each other that the proportions between the volume of the gas evolved by the decomposition of water, and that of the gas resulting from the distillation of coal, may be as 4 : 6. The gas should be tested in its passage to the gasometer by a test-burner; and if it burns with a bright smoky flame, more water should be supplied to the vertical retorts; but if it burns with a faint blue flame, then more of the liquid hydro-carbon should be supplied to the horizontal retorts.

2. The patentee proposes to manufacture oxygen gas for illuminating purposes, by employing nitrate of soda or potassa. Two or more detached moveable crucibles, partially filled with either of these materials are placed in a retort, which is treated in the

ordinary manner. The number of retorts employed may be varied according to the wish of the operator and the capacity of the oven. The oxygen and nitrous fumes disengaged ascend into the hydraulic main, which contains water or lime-water. The oxygen is conducted to an apparatus where it is freed from aqueous particles, and thence to the gasometer. The nitrous fumes are absorbed by the water in the main, and form nitric acid, which is drawn off as may be deemed necessary. The residue in the crucibles forms carbonate of soda or potassa, according to the substance first used, which are valuable as articles of commerce; or they may be treated with nitric acid diluted with twice its volume of water, after which the water is to be evaporated. The residue will be either nitrate of soda or potassa and may be used again.

The improvements in heating and consuming smoke, consist in causing currents of the water gas, and of atmospheric air or oxygen, to meet and burn in a suitable vessel or behind the bridge of the furnace.

The patentee claims:—

1st. The mode of combining and arranging the parts of the apparatus, and the mode of constructing the horizontal retorts with a division or divisions, to extend the heated surface in contact with which the generation of carburetted hydrogen gas, and its combinations with hydrogen gas and oxide of carbon gas, take place.

2nd. The mode of manufacturing oxygen gas by exposing the materials from which it is to be obtained to heat in detached and moveable retorts, of suitable construction, heated in the ordinary manner.

3rd. The application of gas evolved by the decomposition of water combined with atmospheric air or oxygen to produce heat, or with atmospheric air to consume smoke, by a current of it being directed into the flues through which the smoke passes.

ON THE COMBINED USE OF BASIC ACETATE OF LEAD AND SULPHUROUS ACID, IN THE COLONIAL MANUFACTURE AND THE REFINING OF SUGAR.*

BY DR. SCOFFERN.

ACCORDING to Dr. Scoffern, the quantity of pure, white, crystallisable sugar existing in the juice of the sugar-cane is from 17 to 23 per cent., and the juice contained in the cane amounts to about 90 per cent., of which, on the average, only 60 per cent. is extracted; of this only one-third part of its sugar is obtained, and that in a dark and impure condition.

The process at present followed in the production of sugar, involves the use of lime, which, although beneficial in separating certain impurities and decomposing others, does so only at the expense of two-thirds of the sugar.

Some curious plans have been tried for avoiding the use of lime; hydrated alumina has been used, with very little success. As a purifying agent, the basic acetate of lead is known to be most powerful; but from the want of a sufficient means of separating any excess of that agent, it cannot be generally employed. Dr. S. effects this separation by means of sulphurous acid forced into the solution of sugar. The process, according to Dr. Scoffern, has been in use for more than twelve months at a large refinery: a sample of the sugar prepared by this process was exhibited to the Section.

The following is a summary of the advantages presented by this process:—

In the case of cane juice, and other natural juices, containing sugar, it enables the whole of the sugar to be extracted instead of one-third, as by the present process; the sugar may be obtained perfectly white, if required, without the employment of animal charcoal. Owing to the complete separation of impurities, no scum rises on the juice when boiled; consequently the labor of skimming is saved. The process of curing is effected in less than one-third of the time at present required, and the sugar, being always pure and dry, does not lose in weight during the voyage. It enables the manufacturer to work up staples of such impurity as could not be used in the old process, and these staples yield a produce equal in quality to the best refined sugars heretofore produced, in greater quantity and in less time. The operation of scum pressing, and the employment of blood and lime, are avoided. The cost is less than by the ordinary process.

Dr. Miller observed that it had been objected that in this process the sulphurous acid absorbed oxygen, and, passing into the state of sulphuric acid, injured the grain of the sugar. Dr. Playfair said that it had been stated that sulphurous acid gave a taste to the sugar. Dr. Scoffern said that his specimens proved that these objections did not hold good. A member having inquired if voltaic electricity had been found successful in removing the salts of lead from the sugar, Professor Faraday expressed his opinion that it was not practicable. Professor De Vry thought the molasses would contain acetate of *lead*, which would render it unfit for the use to which it is put in Holland.

* British Association.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

SANITARY NOTES.

NO. II.

THE second chief requirement in the sanitary economy of a large population is water; and the necessary accompanying conditions are, abundant quantity and good quality.

The Registrar General has well remarked that "circulating water is the life blood of a city." As it is palpable that the principle of life in all nature is opposed to stagnation, it may fairly be also asserted that in stagnation there is a principle of death. Water, if allowed, in small quantities, to become stagnant, very soon acquires properties injurious to health. In large towns the corruption of the air from various causes, such as the human breath, smoke, foul drainage, &c., is rapidly communicated to the water, and even affects the local springs. Professor Liebig found nitrates in the wells of the town of Giessen, whilst at a quarter of a mile from the town there were no traces of any. In the same manner nitrates are found in the wells of Manchester and London.

An analysis of the air of an ill-ventilated room, discovers sulphuric acid, chlorine, and a proportion of impure albumen in a state of rapid decomposition, during which it gives out carbonic acid, ammonia, sulphuretted hydrogen, and other gases; and there can be no doubt, especially to those acquainted with the peculiar atmosphere of the rooms of the poor, that both damp walls and small deposits of water, as in cisterns, butts, or pails, readily absorb these and miasmata of every description, and give them out again under varying conditions of time, use, and heat. But when these causes of the deterioration of water are assisted by the direct corruption of organic substances, whether animal or vegetable, the evil is extended to a frightful degree. The following statement made by an eye witness in the month of September, 1849, gives an account of, perhaps, the worst "water supply" to be found in the inhabited world; the natural consequence of the practice there detailed has been that, both in 1832 and 1849, the cholera raged to a fearful degree in this most unhappy street, while the ordinary appearance of the inhabitants is of that pale morbid nature, which always betokens a complete unacquaintance with active health.

In London-street, Bermondsey, there is an open ditch communicating with the tide, but without means for scouring and cleansing, and most of the houses have little galleries projecting over it. "In this ditch the appearance of the water was more like watery mud, than muddy water; we saw drains and sewers emptying their filthy contents into it, and doorless privies in the open road built over it; we heard bucket after bucket of filth splash into it. And yet we saw a little child from one of the galleries opposite, lower a tin can with a rope to fill a large bucket that stood beside her. As the little thing dangled her tin cup as gently as possible into the stream, a bucket of night-soil was poured down from the next gallery. In each of the galleries that overhung the stream, a similar tub was seen where they put the mucky liquid to stand, so that they may, after it has rested a day or two, skim the fluid from the solid particles of filth, pollution, and disease." Who can be surprised that scarcely a house in that street is ever free from disease of some kind!

Another illustration may be cited of the dangers of bad water. In a small square court, in London, of five houses containing 22 persons, the water is derived from a well, sunk below the level of a sewer; in the centre of the court is a cesspool to receive surface drainage, and the overflow of the cesspools of the houses; there is also close

to the well, a hole filled with refuse and the soaking from a manure heap. The report states that the smell of the water from the pump was always most offensive. In that court 11 out of the 22 inhabitants have been carried off by cholera. In a neighbouring court of the same size, supplied also by a pump, but without the other nauseous adjuncts, the water is sweet, and there has not been a single case of cholera.

In St. Giles's, East Smithfield, St. George's, Southwark, Poplar, Islington, and other parts of London, the poor are supplied from standcocks to which the water is laid on twice or thrice a week; but it flows for too short a time to enable all the neighbours to fill their pails or pans, and the painful consequence is that the strongest get some supply, while the weaker have to buy, beg, or steal the water they absolutely require. The distress and tyranny caused by this intermittent arrangement is inconceivable to the uninitiated.

That the injurious effects of bad water upon the human constitution are not confined to particular localities, is plainly to be noticed by the following extract from the report of an American physician, on the water supply of New York:—"It is evident that the health of a whole community may be so affected by impurities in the water drank by them, as to give a peculiarly morbid expression to their countenances, which causes the observant eye of a traveller to remark it, while he in vain endeavors to account for the phenomenon. Who has not remarked the expression common in some of our cities, as in New York and Boston, which is called a 'care-worn and anxious expression?' This expression, I will venture to assert, is not so much the result of 'too much care' as it is of abdominal disease, produced by the habitual and continued use of impure and unwholesome water, which has fixed upon us this morbid stamp."

It must be now considered as an established axiom, that the stagnation of water, when exposed to corrupting influences, is most dangerous to health; and that in all communities those causes of corruption are always present. A circulating stream of water through every street, ever running, ever pure, is as necessary to the health of the inhabitants of a town as the circulating stream of blood is to the health of the human body.

The purposes of a full supply of water are fourfold. 1st, for domestic and manufacturing use; 2nd, for baths and washhouses; 3rd, for public use in cleansing streets, roads, courts, drains, and sewers, and extinguishing fires; 4th, for public ornament. Each of these purposes forms a link in the sanitary chain, which should bind together the personal comforts and moral elevation of any large community. But these four purposes do not require the same description of water; the first and second require water of the lowest degrees of hardness, while any clean water is sufficient for the third and fourth. In those places, therefore, where the supply of soft water, whether natural or artificial, is limited, it should be carefully separated for domestic purposes, and a double water-service is absolutely necessary.

Dr. Clarke has proposed to take as a measure of the hardness of water, which is mainly owing to the bicarbonate of lime, that 1 degree of hardness is caused by the presence of 1 grain of chalk in 1 gallon of water. This standard appears to be accepted by waterworks' engineers. It is very desirable to have a full list of the comparative hardness and detailed analyses of water all over the kingdom, that it may be obvious at a glance what is the nature of the water from the different soils and strata. A complete record of these facts would much facilitate the working out of the important object of obtaining a good supply of water in every town, as a social and national necessity, and this will be found practically to be the only effective and economical method of treating the subject.

Dr. Clarke's method of softening water is perfectly applicable in any case, and the use of it should be insisted on. It consists merely in the use of quick lime, under certain regulations, to take up the carbonic acid which holds the chalk in solution. It has been estimated that the effect of the use of this process upon the water at Manchester would effect a saving of £35,000 per annum in that town, in the use of soap and other articles. Dr. Clarke estimates that his process applied to the water from the

Thames would effect a saving of 18 oz. of soap to every 100 gallons of water used in washing; and if applied to water from the river Gade, near Watford, would effect a saving of 27 oz. of soap to every 100 gallons of water. The cost of the process, added to the water-rate, could not amount to one penny per annum for each person; an additional expense which bears no proportion to the amount of saving in various domestic articles, as well as the wear and tear of clothes. Water required for the two first purposes should not exceed about 4° of hardness.

When the supply of water is derived from surface drainage or rivers, attention must be carefully paid to the removal of mechanical impurities which may be drawn from the soil during the percolation or flow of the water. It must then undergo the process of filtration, either by artificial means or by subsidence. There are several kinds of filters. In the "natural filter," the water is made to percolate through a natural bed, or stratum, of sand into reservoirs, as at Glasgow and Nottingham. But this is only applicable when a bed of sand free from springs, &c., can be obtained. The annual expense of filtration at Nottingham is about one penny for 3,000 gallons of water. The most generally-used method is that by the "Lancashire filter," which consists in an arrangement of gravel in four or five beds, commencing with large stones on an impervious foundation, and having at the top fine sand or charcoal. The impurities of the water are generally deposited in the first bed, which has to be frequently renewed. The cost of filtration varies considerably, for at the Chelsea waterworks only about 2,200 gallons are filtered, at the cost of one penny; while at Battersea, where there is a "subsiding" reservoir as well as the filter, the quantity of water purified for one penny exceeds 9,000 gallons. Mr. Thom has constructed in several towns a variation of the Lancashire filter, by which it is made self-cleansing, and a saving is effected in the annual expense.

The establishment of baths and washhouses should be encouraged in every town. The baths are of the greatest value, even in this temperate climate, in cleansing and refreshing the skin; and equally valuable are the washhouses where the poor can wash and dry their linen. The necessity of hanging up the wet and steaming clothes across the rooms in which they live and sleep, for the purpose of drying, is to the poor a most prolific source of disease; and can only be avoided by one of those public institutions, at which the process can be performed in a comparatively short time, and where the improvements and advantages of science are brought within reach even of the indigent. The arrangements in progress and nearly completed at the establishment for the parish of Marylebone, appear to combine every necessary, if an unlimited supply of water can be secured.

The necessity—both on pecuniary and sanitary considerations—of a free supply of water for cleansing roads and sewers, cannot be entered on now. Both objects are of the highest importance in what has been called the sanitary economy of any population. Meanwhile, all persons having the well-being of their fellow creatures at heart, and possessed of those scientific acquirements which enable them to appreciate and understand all subjects deeply affecting the public health, are earnestly called on to exert that powerful influence which science always bestows on her votaries, to rouse their friends and neighbours, of every degree, to a sense of the dangers originated by the use of bad water, and make plain the necessity and possibility of obtaining a good and proper supply of such an important article of daily, hourly, use as good water. There is not within the limits of these favored islands a single permanent assembly of human beings, that has not good water within its reach. Oh! let not the blessings of a munificent Providence be always neglected!

J. N. W.

DISINFECTORS AND DEODORISERS

The Parliamentary Reports on the use of "disinfecting" fluids, a long detailed report issued by Sir William Burnett, as regards the use of his own particular fluid, and a report, signed by Mr. J. T. Cooper, have been laid before us.

It is impossible to review these papers without arriving at the conclusion that we

are in possession of agents, which, if properly applied, are capable of preventing the evolution into the atmosphere, during the cleansing of cesspools, &c., of those vapors which our natural instinct directs us to avoid. There are three fluids for deodorising now before the public—the chloride of zinc, the nitrate of lead, and one which is called Ellerman's—a complicated compound, the principal constituents of which are sulphate and chloride of iron.

That each of these solutions is capable of destroying the foetid odor arising from decomposing organic matter is beyond doubt; and almost the only question to be considered is, which is the cheapest, most simple, and least dangerous in the hands of the public. Of these three solutions, for the uses alluded to, we are inclined to give a decided preference to Sir W. Burnett's, and its extensive use *by the public*, for the purification of the *house-drains* should be urged in every possible way. The public is by far too apt to rely upon the exertions of official bodies, and, instead of aiding, to throw every possible obstacle in the way; but it is hoped that the painful lesson which has been so recently taught us will not be forgotten; for how soon we may again be revisited by this or some other scourge it is impossible for us to say.

At the time when the cholera was raging in the city of London, Sir W. Burnett, with his usual philanthropy, supplied the city authorities with his solution at cost price; and Lieutenant Jackson attended before the Lord Mayor to make some statements relative to it. This gave umbrage to the *liberal*-minded editor of the *Pharmaceutical Journal*, who forthwith penned an article, entitled "A New Mode of Puffing Quack Medicines." In what way the use of chloride of zinc, as urged by Sir W. Burnett, can be considered as a medicine, it is difficult to discover; a little explanation is certainly necessary.

There is a compound prepared by Mr. Collins, for the evolution of chlorine and chlorous gases, which supersedes, in our opinion, all others to which our attention has been called, for deodorising and disinfecting *apartments* where contagious disease has been (except the employment of the ingenious apparatus invented by Messrs. Heathfield and Burgess, in which the quantity of gas eliminated can be regulated); but these are, perhaps, not so easily applied, and, at any rate, not more advantageous than the solution of chloride of zinc, for *arresting* the decomposition of *solid* or *fluid* organic matters, or deodorising when decomposition has commenced.

It appears to us that the evolution of chlorine gas, under one set of circumstances, and the employment of the chloride of zinc solution under another, should be promoted in every possible way.

Every housekeeper should occasionally pour a little of the chloride of zinc solution into the sink; and, at night, in those houses which have underground kitchens, and drains which lead to the main sewer, a wet cloth, or better still, a flannel, which has been steeped in the solution, should be placed over the aperture. The reason why we urge this mode of procedure upon the public is, because, during the *flushing* operations which are carried on, the foul gases constituting the atmosphere of the sewers, are driven up through the house drains into the kitchens, to the great injury of the health of the inhabitants; and this is the great reason why the *flushing* has been so much complained of, and why every one declares that the sewers have been more disgusting during the recent hot weather then they can ever previously recollect them to have been.

Of the poisonous qualities of the gases which collect in sewers, we have a very painful instance fresh in our memories. We allude to the case in Pimlico, where the five lives were lost. This is a very sad case. The medical gentleman who went to the assistance of the three poor fellows who were the first victims, was brought out dead within three minutes from the time he entered, by a policeman of the name of Walsh, who went with him; this brave fellow re-entered and rescued another man who accompanied them, and was overcome. Walsh, poor fellow, then re-entered the third time, his last, and has left an aged father and mother (who were dependent on his labor for their daily bread) almost frantic at his loss, and, in all probability, they have nothing but the workhouse for their reliance.

We have heard that, at last (after the matter has been urged for at least ten years), an endeavor is to be made to ventilate the sewers, by means of one or more large shafts; at least, an experiment is to be made with that view, and it is to be hoped that the public will carefully watch its progress, and see, if possible, that it is not converted into a job.

It is worthy of note, that all the metallic matter about the persons of the unfortunate victims above-mentioned was turned black; proving that there was a large accumulation of sulphuretted hydrogen.

Before we quit this subject—after repeating our opinion that it is the imperative duty of each and all of us to do our portion, by looking to our own residences, and not leaving the whole to public bodies, who, at the best

of times, move very tardily, and spend by far the greater portion of their time in talking and quarrelling—we would suggest that some endeavor should be made to otherwise dispose of the sewage emanations than by casting them into the River Thames. This ought to be done. The state of this once beautiful stream is disgusting in the extreme; but we shall return to this subject at a future period.

THE PHARMACEUTICAL SOCIETY.

The monthly meetings of this Society were resumed on Wednesday, the 10th inst., the President in the chair. Business commenced by the distribution of the prizes awarded to the pupils of the Institution at the end of last session. These consisted of three copies of Turner's "Chemistry," a Lindley's "Vegetable Kingdom," Thompson's "Dispensatory," and Fresenius's "Analysis," all handsomely bound, and distributed as follows:—

Materia Medica—Two equal prizes to Messrs. Thos. Yrask, of Camden-town, and Edmund Greaves, of Bloomsbury-square.

Chemistry and Pharmacy—First prize to Mr. Edmund Greaves; second prize to Mr. Augustus Bird.

Botany—First prize to Mr. J. R. Walker; second prize to Mr. C. R. Quiller.

Donations to the Society were announced as follows:—Fifty poisoned arrows, and a quantity of Wouralai poison, from Pirari, presented by Mr. T. M. Stone, of the College of Surgeons. A specimen of earth with a blue vein, from a tumulus near Salisbury; presented by Mr. Cocks, of Salisbury. A concretion from the stomach of a horse, presented by Mr. W. G. Guntar, Veterinary Surgeon, Borough. A copy of Scott's "Bible," Messrs. Seeley, 6 vols., illustrated edition; presented by Mr. Giles Yard, of Lamb's Conduit-street. A specimen of the Sandal Root noticed by Dr. Granville; this root has the odor of musk; it is very rare, the present is only the third specimen in the country. Nine specimens of medicinal plants; presented by Mr. Kent.

The PRESIDENT called upon Mr. Bell to introduce the subject of the evening's discussion: The Sale of Poisons and the Means of Preventing Accidental and Criminal Poisonings.

Mr. J. BELL said, the subject they had met to discuss had been brought under the notice of the Pharmaceutical Society by the provincial Medical and Surgical Association, and a series of questions had been addressed to the members of the Society by Dr. Tunstall, of Bath, with the view of ascertaining what practical means could be adopted for preventing the frequent crimes and accidents resulting from the improper use of arsenic. It appeared to him that the matter divided itself into two questions, first, whether it were possible to do anything at all to prevent this evil; and, secondly, whether the remedial measures, if any, should be applied to the sale of arsenic only, without including other poisons. It must be evident to all that something should be done, to prevent persons who called themselves chemists and druggists from selling poisons of any nature. At present there was no law to prevent those persons from doing so, and no means of bringing them to justice until some fatal result had taken place from the poisons they had sold. A restriction on the sale of poisons in small quantities would be a very great protection to the public, especially where arsenic was used, for a very large portion of the arsenic at present employed in criminal attempts was sold by small shopkeepers, in obscure and out-of-the-way places in the country districts. It would make such persons much more cautious, if they were made to a certain extent responsible by law. It was obvious that it was of no use proclaiming by a law that no person but a chemist should sell arsenic, when there was no legal means of defining what a chemist was; and it was also doubtful whether it would be useful to restrict the sale of arsenic at all in small quantities when there were other poisons which no chemical skill could detect after death had been caused by them; and if arsenic went out of fashion with the family poisoners, some other poison, equally easy of administration, would be discovered and put in operation. It might be reasonably inferred that the people generally could know nothing of such poisons; but if any ingenious person, perhaps, did use another poison, it was circulated by the newspapers, and all the details were at once known. He thought the publication of these poisonings a vicious system, and one which, in its results, was extremely mischievous. If arsenic were prohibited, ought they not also to prohibit opium, henbane, hemlock, &c. He knew that in the country the people were constantly asking chemists for "stuff" which was generally understood to mean opium, and it was a poison in common use, small quantities being used instead of drachms. A mixture of opium and treacle is given as a sedative or soporific to children, whilst the mothers are at work; thus, in fact, poisoning them by wholesale. In the evidence adduced before a parliamentary committee, not long since, strong facts were adduced in reference to the poisoning of children in this

manner. He thought that all who were conversant with this matter admitted as a general principle, that there was no real occasion for the people to use arsenic in small quantities at all, either for the destruction of vermin or for any other purpose; but there could be no doubt from the quantity of arsenic sold, that it must be used very freely for such purposes. One gentleman he knew had sold during the last three years between 3,000 and 4,000 cwt. of arsenic—a sufficient argument for the extent of the retail as well as the wholesale trade in the article. It was highly essential that some law, which would not interfere with the legitimate use of arsenic, whilst it should restrict the retail trade, should be passed; and then again arose the difficulty of passing such a law, which would not operate injuriously to the chemist and druggist. This was the trouble in which they were, and the Pharmaceutical Society, therefore, sought the aid of its members and the profession generally as to details and facts coming under their own knowledge, in order that some law which would meet the exigencies of the case might be framed. If they could succeed in that they would have occasion to congratulate themselves and society in general that the subject had been taken into consideration by them.

Dr. TUNSTALL said that there was no doubt that arsenic was indiscriminately sold for the ostensible purpose of destroying vermin, and this was particularly the case in Lincolnshire, where many of the secret poisonings had taken place. (Hear.) It was certainly required, in some places, that the person purchasing arsenic should be accompanied by a witness, but the great evil arose from the fact that the witness was not always personally known to the chemist, and, sometimes, hardly known to the person purchasing the poison. They were all aware that arsenic was not necessary for the destruction of vermin, but there were other uses for which it was sought. It was used for stuffing birds, to prevent their becoming rigid; it was used as an outward application for disease in sheep, for killing wire worms, and for steeping wheat to prevent smut. In Manchester it was used for experiments in dyeing and other manufactures. In Leominster it was used to destroy insects, &c. Now, the disease in sheep was better treated by arsenious acid than by crude arsenic, and it might be that the use of the poison exercised a deleterious effect upon the mutton consumed in London and elsewhere. Sheep frequently die after arsenical dressings, and the farmers are ignorant of the cause; and sheep dressed in this manner are frequently slaughtered and used as human food; the tissues in all these animals are more or less affected by the mineral. Professor Taylor, in his work on "Medical Jurisprudence," says (page 68), "When it is applied to an abraded or ulcerated surface, it is absorbed, and produces all the effects of poisoning. A man who used it as a depilatory, died in 20 days; two children, who used it for scald head, died; a man was tried at Chester, in 1844, for causing the death of a woman by the application of an arsenical plaster; and Dr. Brett, of Liverpool, detected arsenic in the stomach, liver, and spleen. It is a singular fact that the stomach is always affected, whether the poison is taken into it or applied to an abraded or ulcerated surface." This is confirmed by Mr. Herepath's experience. It would be a boon to the public if veterinary surgeons and practical chemists would take opportunities of examining the stomachs of sheep, in order that we might arrive at positive facts upon the subject, but it might fairly be assumed that many sheep suffering from the accumulative effects of arsenic are killed, and sold to the public. He had been informed that sulphate of copper answered better than arsenic, and no doubt it would be used when the cause of the death of sheep was traced to arsenic. The suicides that had taken place in a given time showed the sale of arsenic afforded a fatal facility. Of the suicides in 1840, no less than 5½ per cent. were by arsenic. A gentleman in Lincolnshire, writing to him as to the comparative sale of poisons, stated that he sold a quantity of arsenic, from 50 to 100 gallons of laudanum yearly, besides morphia, strychnine, bichloride of mercury, &c. A gentleman from Manchester, informed him that the sale of Godfrey's cordial was carried on by the small grocers to a great extent, and that there was a demand for arsenious acid, oxalic acid, prussiate of potash, and other poisons. In Leominster there was a great demand for corrosive sublimate. If the sale of poisons were restricted to adults, and other stringent laws enacted, the suicides would, as eloquently expressed by a living divine, be driven to the rope, the razor, and the river; and a great source of unavailing regret would be removed from those who had the sale of the destructive agents. One effect of a licence would be that the sale of drugs would be taken away from those who were so ignorant as to mistake laudanum for tincture of rhubarb, and oxalic acid for Epsom salts, and who sent out from their shops all sorts of poisons in unlabelled bottles. The effect of the present system, and the want of some restriction, was shown by the fact, that the population of Surrey exceeded considerably that of Man-

chester, and yet from the free use of opiates in the latter place the deaths were 16,000 more in seven years than in Surrey. The present system should be put an end to, and it would be destroyed if medical men would unite together in the grand design of protecting their own interests and those of the public.

The President produced a register which had been kept for many years by Messrs. Hitchcock, in which every sale of poison was entered, under five columns, according to the kind of poison, the date of sale, the purpose for which required, the purchaser's name, and that of a witness. By this means Mr. Hitchcock believes he has prevented two suicides.

Mr. Morson observed, that on the Continent the registration of such sales, and the presence of a witness, was compulsory.

The President characterised the plan as inconvenient. Some time ago, a physician on the Continent having occasion for laudanum in the middle of the night, was unable to obtain it for want of the requisite signatures.

Dr. Simpson would support a proposition for doing away with the sale of arsenic in small quantities, and for certain purposes. A law passed to that effect would be a greater service to the public than any rendered by medicine since vaccination was introduced. He would advise the council to be cautious and guarded in their proceedings; he was sure that in these times it would not do to ask too much from the Legislature. Let them take a lesson from the present position of the medical reform question. They had been agitating that for many years, and who could say they were nearer to its attainment in 1849 than in 1842. The attempt to organise the body of *pharmaciens* was laudable, but any injudicious mixture of the two questions might obstruct the progress of a law to put down the horrid evils of poisoning.

Dr. Ure thought the arguments of Dr. Tunstall and Dr. Simpson irresistible; he quite agreed with the latter on the question of the policy of pursuing this object independently. He was sure that arsenic was of no use for the purposes for which people who now obtained it in small quantities pretended to procure it. The German compound of phosphorus and lard was superior to arsenic as a destroyer of rats and mice; and bugs were not to be killed with the latter poison. As for steeping wheat in a solution of arsenic, it was a detestable practice, and did not answer the purpose. The sulphate of copper, extensively used on the Continent, was infinitely superior. He agreed with Dr. Simpson that it was unwise to ask too much. We had a Government which did not care for the lives of the people; but they might very well ask Government to stop the sale of arsenic; and as for those who wished to go out of the world, why there were plenty of ways of doing so without involving a chemist in embarrassment, by obtaining from him the instrument of death. There was no doubt that, in regard to poisoning generally, the best security of the public was in the acquirements and character of the dealer in poisons. He had attended an examination for the *pharmacien's* licence at Berlin, when Mitscherlich was examiner, and the questions put and answered were such as would have puzzled many professed chemists, he would not speak of dispensing chemists, to answer.

Mr. Waugh objected to a licence. He also thought the methods for coloring arsenic were inefficient. Clever people, and the poisoners generally were clever, would laugh at them. If what had been stated were true, why not go and ask Parliament for a law to put an end to all retail sale of arsenic, and ensure its respect by a heavy penalty?

Dr. Tunstall said that none of the Bath chemists sell arsenic. In Manchester its sale is prohibited by the law which incorporates the town. He had received various answers from chemists on this subject. One house said, "I thank God we never see the stuff." Another says, "We should not serve you at our shop, though you are a medical man; we would let you have liquor arsenicalis." The question of licensing its sale was mooted before the necessity of selling it at all was gone into.

Mr. Redwood had had considerable experience in the dispensing business before he became a teacher, and was convinced that the sale of arsenic in small quantities was wholly unnecessary. He knew of no reason why the sale should not be foregone.

The meeting separated at eleven o'clock.

A committee, consisting of the most influential members of the profession, was appointed for the purpose of collecting evidence with which to go to Parliament for an alteration in the present system.

NATURAL HISTORY OF QUINQUINAS.*

BY DR. WEDDELL.

In 1843, M. De Castelnau, having been charged with a scientific expedition to the interior provinces of Brasil and Peru, the Museum of Paris appointed Dr. Weddell to take part in it, with the special mission of

* *Journal de Pharmacie*, Sept., 1849.

studying certain important subjects of botany, and other branches of natural history. After two years' exploration in company, Dr. Weddell parted from M. De Castelnau, on the confines of Mattogrosso, in order to pursue his investigations in a different direction, and he continued them until 1848. The subject of the quinquinas, so much discussed, and still so obscure, particularly occupied his attention. It was this that guided his journey, and the results of his laborious researches are the subject of a work, which will form a magnificent volume in folio, with numerous engravings, and which has appeared to us so interesting, in a pharmaceutical point of view, that we do not wait until it is published to lay it under contribution for the benefit of out readers. Dr. Weddell, with the greatest kindness, having placed at our disposal the first sheets of his work, we have hastened to extract from it some details, which give an idea of this enterprise, and which excite the greatest interest in the young savan whose zeal, intelligence, and courage have enabled him to accomplish it.

From La Condamine, who first made known in Europe the quinquina tree to the illustrious travellers, Humboldt and Boupland, to whom we owe the first observations on the geography of this kind of plants, a host of men of science of all countries have made it the subject of researches, and a mere list of the works published on this matter would occupy many pages. Few, however, of those who have described the quinquinas have studied their native country; and the observations of those few have served as the matter of most of the other works.

The origin of quinquina bark was long a mystery. It was La Condamine who gave us the first glimpse of it; but the way which he opened was only very slowly followed up. In 1735, Joseph de Jussieu accompanied, as botanist, the Commission of the Academy of Sciences, sent out to measure a degree of the meridian under the equator. He visited, almost at the same time as the celebrated astronomer, the quinquina forests of Loxa, those of Upper Peru, and penetrated almost to the frontiers of Brazil. A succession of unfortunate accidents prevented the publication of his researches. He did not return to Europe until 1771, deprived of reason, after an absence of thirty-six years.

Thirty years later, two expeditions were employed to explore the quinquina districts of Lower Peru and New Granada; the one directed by the celebrated Mutis, the other by Ruiz and Pavon. The immense investigations of these naturalists did not, however, make such great progress in the history of these vegetables as there was reason to expect. Since the observations of Humboldt and Boupland, who afterwards traversed the same countries, the district where the quinquina is worked has been greatly increased by the discovery of new districts, and commerce is enriched with a number of kinds which were formerly unknown.

Until the year 1775 no kind of quinquina, but that of Loxa, was known in the market. It was only in 1772 that Mutis, for the first time, observed the precious tree in the neighbourhood of Santa Fé de Bogota, at which period also Europe began to receive quinquinas which did not double Cape Horn, but which were embarked direct from the ports of New Granada on the Atlantic. Some years later, the authors of "Flora Peruviana" studied the species of Lower Peru, to the north of Lima, and commerce was also supplied from this source. The only kinds, therefore, which remained unknown in Europe, botanically speaking, were those inhabiting the vast extent of country behind the Great Cordillera, to the south of these latitudes. Despite the efforts of Joseph de Jussieu and of the botanist Thaddaeus Haenke, quinological science reaped no advantage from their voyage. The object of Dr. Weddell's work is to make known the species which he observed in these regions during the years 1845-6-7. The immense increase of quinquina taken by commerce from these parts, to the detriment of the ancient forests, rendered a new work on them in some measure necessary. At a period when the consumption of these barks is becoming more and more considerable, it is useful to call attention to those which, some day, must replace the *Quinquina Calisaya*, whose exhaustion becomes more and more imminent. These species, although less rich in active principles, still present, from their abundance, some security against an early chance of seeing ourselves deprived of one of the most valuable medicines of the vegetable kingdom.

Dr. Weddell penetrated into Bolivia in the month of August, 1845, by the country of the Chiquito Indians. The conformation of the soil of this province is utterly incompatible with the existence of the true Cinchonas. The greater part of the surface is so low and level that, during the rainy season, it is quite under water. In the month of November he directed his course to the south, gained Rio Grande, and passed through the province of Cordillera to Tarija, where he arrived in January, 1846: a tedious journey, the object of which was to define

with accuracy the southern limit of the Cinchoniferous region.

Dr. Weddell gave the name of *Cinchona Australis* to the species which he discovered, at this extreme point, towards the 19th parallel of south latitude. In the month of August following he visited some large towns of Bolivia. At Cochamba commenced a curious feature of his exploration. He crossed near there the great chain of the Andes, with the design of arriving at Paz, where a large trade in quinquinas is carried on. The Andes present in this part a long and beautiful series of natural steps, which the traveller gradually descends, passing successively in review all the varieties of climates, and all the corresponding tints of vegetation. The different kinds of cinchona multiplied under his view. Almost immediately on his entry into the province of Enquisivi, he had an opportunity of studying that which produces the Quinquina Calisaya, the most valuable of all these barks, from the large proportion of quinine which it contains. He gave to this still unknown plant the name of Cinchona Calisaya. At Palca, he was told that an immense forest of quinquinas, which no one had worked, had just been discovered on the banks of the River Ayopaya. But it was in the province of Yungas, the richest and most fertile of Bolivia, that he obtained the most accurate information concerning the mode of working, the preparation, sale, and adulteration of the barks he desired to study.

In 1847, after the rainy season, Dr. Weddell resumed the road of the Cordillera Grande. The town of Sorata, or Esquibel, situated at the eastern side of the Andes, and at the foot of one of its highest peaks, is commonly regarded as one of the best sources of Bolivian quinquinas; whereas, in reality, it is only a simple point of transit for the produce of the valleys of the interior. It was towards these that he directed his course, passing over the snows of Illampo. The River Tipoani, the Pactolus of Bolivia, takes its rise here. One of the worst roads in the world passes along the ravine of the same name, and leads to the village of Tipoani—a pestilential place, which nothing but the allurement of gain could cause to be inhabited. As much sought after as gold itself, the quinquinas are met with throughout this region; but the large trees are already beginning to be scarce. In order to study these, at present, still virgin points, Dr. Weddell embarked on a raft which he had constructed, and by means of which he safely descended the rapids of the river Tipoani. He afterwards visited the mountains of the river Tumache. This exploration being finished, he went on his raft down the River Mapiri, and regained the paths which lead across the forests towards Aten and Apolobamba, where he arrived, exhausted with fatigue and stricken with the fever which he had caught in the marshy flats of Tipoani. Here the country assumed a more smiling aspect; the forests had disappeared, or occupied only the horizon; the eye rested everywhere on pretty turfy hills, lightly sprinkled with shrubs, and often even with beautiful thickets. Sometimes quinquinas were met with, which scarcely exceeded the size of shrubs, and whose flowers filled the air with a delicious perfume. The town of Apolobamba, is the centre of one of the most anciently worked points of Bolivia; its forests have long been depopulated of quinquinas.

At the end of June, 1847, Dr. Weddell visited Coraboya, one of the most interesting provinces of Peru. It is divided by the Cordillera into two regions, one of them comprising a long series of valleys, which furnishes the greater part of the quinquinas now exported from the Peruvian Republic. It would be difficult to give an idea of all the treasures of vegetation buried in these solitudes. The thirst for gold peopled them formerly, but the forest has everywhere resumed its empire, and the axe of the *cascarillero* now alone disturbs its silence.

Here we will let Dr. Weddell speak for himself:—

"The name of *cascarilleros*," says Dr. Weddell, "has been given to the men who cut the quinquina in the woods; this appellation likewise extends to all who trade specially in it. The first—the only ones of whom I have to speak here—are in general men trained up to this hard work from infancy, and accustomed, by instinct, to guide themselves in the midst of forests. With no other compass than that intelligence peculiar to men in a state of nature, they guide themselves as surely in these inextricable labyrinths as if the horizon were open before them. But how often has it happened that less experienced people have been lost, and never seen again!

"The only season improper for the quinquina harvest is during the prevalence of the rain, which, as regards the period and duration, is almost equivalent to our winter. If some persons pretend that the time of the rising of the sap is most favourable for the purpose, their precepts are not followed in practice; and an exception is made in favor of the rainy season, only on account of the physical obstacles which accompany it.

"The cutters do not, in general, seek the quinquina on their own account; most fre-

quently they are employed by some merchant or small company. A trustworthy man is sent with them into the forest, under the title of *mayordomo*. It is his duty to receive and examine the barks which are brought to him from different parts of the forest, besides superintending and distributing the provisions.

"The first care of one who undertakes a speculation of this kind, in a still unexplored region, is to have it reconnoitered by experienced *cascarilleros* called *diestros*, or *praticos*. The duty of these is to penetrate into the forests in different directions, and to ascertain at what point it may be profitable to work them. They have to prove the presence and relative quantity of the quinquinas, as well as the direction in which these trees lie, and to bring samples from which the quality of their bark may be estimated.

"This first knowledge is the most delicate of the operation, and it requires in the men employed well proved sagacity and patience. On their report the chances of success are calculated. If they are favorable, a path is opened to the point which must serve as the centre of operation; from this time all that part of the forest which the new road commands, becomes provisionally the property of its discoverer, and no other *cascarillero* may work on it.

"As soon as the mayordomo has arrived with his cutters in the neighborhood of the place to be worked, he selects a site favorable for establishing his camp, as near as possible to a spring or river. He causes a *hangar*, or light house, to be constructed to store the provisions and the crop; and if he expects to remain a long time in the same place, he sows maize and some vegetables. Experience, indeed, has proved that one of the chief elements of success of works of this kind is abundance of victuals. The *cascarilleros*, during this time, are dispersed into the forest one by one, or in small gangs, each carrying, enveloped in his *poncho* (a kind of mantle), and hung on his back, provisions for several days, and the coverings which constitute his bed. It is here that these poor people need to put in practice all their courage and patience, in order that their work may prove fruitful; obliged constantly to have his hand on his axe or his knife, to free himself from the innumerable obstacles which arrest his progress, the *cascarillero* is exposed, from the nature of the ground, to an infinity of accidents which too often endanger his very existence.

(*To be continued.*)

ON PUBLIC HOSPITALS AS THEY ARE, AND AS THEY OUGHT TO BE, AS TO SITUATION, CONSTRUCTION, AND MANAGEMENT.

BY CHARLES WATT, SEN.

(*Concluded from page* 35.)

In pursuing my observations on Public Hospitals, I am fully impressed with the difficulties with which the subject is surrounded, and with the ignorance and prejudice which will, on all sides, be arrayed against me; nevertheless, in accordance with my engagement with the public, I enter the arena without the slightest fear—satisfied that the truths which I shall advance will bear the test of investigation, and will, at no very distant period, be forced upon public attention.

From my statement in the last number of The Chemist, it must be evident that the situations of all our great Metropolitan Hospitals are in direct antagonism to the means employed for the recovery of the patients, and that they greatly frustrate the efforts made by their medical attendants, and the benevolent intentions of their founders and benefactors.

It now becomes my duty to show that their construction and management are quite as unfit as their situation for the objects for which they are intended.

It may here be premised that no large collections of persons in one apartment (especially of long continuance, as in the period of repose) are compatible with health; hence crowded places, as prisons, workhouses, hospitals, schools, and ships, are often visited by diseases. Fever in its worst form—typhus—not unfrequently breaks out in them, from no other cause than the overcrowding alone; indeed, so remarkable is this fact that it has received the several names of gaol, ship, and hospital fever.

Let us for a moment consider the situation of a number of persons remaining in one apartment for any length of time—breathing an atmosphere contaminated by the air exhaled from the lungs, and by the effluvia from perspiration—and we can surely arrive at no other conclusion than that all crowded assemblies, or collections of large bodies of people, are, in themselves, sufficient to originate disease.

In large receptables for persons it must be evident that should any disease occur to any one individual, it will very soon be communicated to others—perhaps, to all—and surely we want no further proof of the rapid extension of disease than the fatal instance in the pauper children asylum at Tooting, where nearly two hundred were sacrificed in

a few days, while not one person in the town was affected.

If then, as is too plain, it is deleterious to health and even sufficient to generate the most fatal disorders, to have a number collected in one habitation, how far greater must be the evil when the parties are the subjects of disease? Let us but take a view of the wards of our public hospitals. In many of these are twenty, or, perhaps, thirty beds, in which are patients laboring under a great variety of diseases. One bed may contain a person with an abscess, another one with cancer, another one with ulcers, and so on—giving out their foul effluvia, and contaminating the air of the whole ward;—is such an arrangement, I ask, consistent with remedial agency, to which pure air is, of all others, the most potent and indispensable auxiliary?

When we contemplate the subtleness of aeriform poisons, and our utter inability to detect them by the most delicate chemical tests, it is impossible not be satisfied of the great impropriety, nay, even risk, of allowing a number of patients, afflicted with different diseases, to dwell, and, more especially, to sleep, in the same apartment. Would any one, not insane, think of allowing a person who has never had small-pox or measles to be in the same room with one afflicted with either of them? And is it because emanations from persons laboring under other diseases are not productive of any specific malady, that they are not injurious, although their effects are not made perceptible by any marked indications? The atmosphere in a room where persons in disease are placed, must, inevitably, be unhealthy, and, therefore, totally hostile to the means adopted for their removal.

In the case of hospitals for the reception of parturient females, supposing (which has happened, and is very likely again to take place) that puerperal fever should occur in one person, would not all the patients within the building, a few days after their confinement, be endangered to the utmost extent? Nay, is not the medical attendant, after visiting patients in typhus, often the means of communicating the disease to women who have been recently delivered? These are questions to which there is but one reply, and that is, that all under the same circumstances run the greatest risk, with scarcely any chance of escape, and if once affected, what is the hope of recovery?

It is quite superfluous to particularise at greater length the different arrangements observed at each hospital; they are all conspicuous for the same defects, and equally require reformation.

In an establishment designed for the reception and cure of persons afflicted with fevers—the London Fever Hospital—some two years ago it was stated, that, from the great prevalence of typhus, the wards were so crowded, having, I believe, one hundred beds in one ward, there was no room for any additional patients. Such is the provision on the restoration of those afflicted with those diseases that they are made to breathe that very contaminated air which is capable of engendering the same affections in persons in health. The cause by which they can be generated is allowed to exist, at the same time that the remedies are applied. Nothing can be more grossly or more culpably improper, and through this impropriety of arrangement two of its physicians have paid the forfeit of their lives in the zealous discharge of their duties, and others have nearly suffered the same fate. Surely, then, little is required to convince any unprejudiced mind of the utter absurdity and danger of this mode of constructing an Institution intended for the cure of fever; and much should I regret, if, without the least assumption, I could not submit to the readers of this journal one totally free from the evils I have briefly detailed, and as eminently calculated for the purpose for which they are established as they now are, in all respects, unfit and opposed to it.

With regard to the management not much need be said. A few general remarks, and the record of certain facts, will suffice to evince a necessity for reform in this respect, as well as in the situation and construction of all places intended for the reception of the sick.

In each of our public hospitals, the physicians and surgeons take a certain number of patients under their charge, and pay them their regular visits, at which the pupils "walking the hospitals," as it is termed, are present, hearing the clinical remarks on each case, in order that they may gain a knowledge of their profession; and although it is, perhaps, absolutely necessary that this should be allowed, yet is it, and especially in the case of females, a sufficient evil to demand the suppression of that levity and indecorum which are but too often exhibited by the pupils on their attendance at the bedside.

That a knowledge of the profession must be acquired by means of clinical visitations is evident, and as these cannot be avoided, the greatest strictness ought to be observed, that no improper conduct or disregard of the feelings of the patients be allowed. With regard to the visitation of the patients by the physicians and surgeons, there is one evil which requires remedy. There are many cases which require more than one visit in the interval of twenty-four hours, in both

surgical and medical cases. And certainly, it must be admitted, these officers do occasionally pay a second visit when particular critical states and symptoms render it necessary; yet are they, for the most part, left during the whole of the night to the sole care of the apothecary and one or more of the senior pupils who have, by the payment of a certain fee, become what is termed a "house-surgeon," who, in certain cases, and on the occurrence of particular and untoward events, do not, however, feel warranted or confident to undertake the responsibility and management of the case, and, therefore, send for the surgeon; during which period time is lost, or he may be called out elsewhere, and the case endangered from want of aid. It is manifest, therefore, that some provision ought to be made by which such occurrences may be prevented, and the appointment of a resident physician and surgeon would supply this deficiency.

Having now brought to a termination my statement as to the situation, construction, and management of public hospitals, it remains for me to submit to the public the plan I have formed, which I am confident is as practicable as it would be beneficial; and in so doing, I will meet all the objections and difficulties which may, *prima facie*, appear insurmountable, and subject them to strict scrutiny.

One of the arguments which will at first be urged against the removal of hospitals, doubtless, will be the necessity of there being some place at hand in all localities for accidents and in cases of a sudden nature—as cholera, apoplexy, and other emergencies. The reply, undoubtedly, is in the affirmative; yet, let it be remembered, that ordinarily these are comparatively few, and in cases of accident, after a certain period, more good would arise from their being in pure good air than in the crowded wards of a hospital situate in the midst of nuisances, such as have been detailed, and I contend that the great advantages gained by their being situated in such places would render them far more useful and even more economical than they now are.

I would here ask, what constitutional or chronic disease is there that has not much more chance of recovery in country air than in that which is poisoned by all the filth of so vast a metropolis as London?

It is not for me here to dwell on the particular situations appropriate for every individual class of diseases. It is quite enough to point out the necessity of a change of locality, and I am convinced that the change would prove of signal advantage to all—as well to the patients as to the funds of these institutions. But I have to provide against another objection which will be urged, and this is the necessity of having these Institutions in immediate connection with the Schools of Medicine and Anatomy. I am ready to admit the fact, and at the same time do not hesitate to state that the sooner both are removed out of London the better; for while the patients under cure are placed in the most advantageous situation, and the town will be rid of a class of young men, without doubt the worst-conducted of any that visit the metropolis for the purpose of instruction, while these will be kept from the vices of London so far as the removal of them to short distances can have this desirable effect.

Is it necessary that the schools of anatomy should be under almost the very eye of the sick in hospitals? Surely all that is required in them is that the pupils should "see cases," as it is termed, and then learn how to treat them. In the late Mr. Brooks's school of anatomy there was no hospital, and the pupils were quite as well taught as they are now at any college or hospital in the metropolis. Is it, I would again inquire, indispensable that, because pupils are required to see operations all the other sick inmates are to be kept in the midst of nuisances, in such a place as London, where there is scarcely one operation to five thousand other cases, and even these would do better in the country?

But, it will be asked, how will it be possible to construct hospitals without wards? The answer is, easily; no wards are required.

It has been stated by some French physicians that malaria do not rise above 20 feet from the surface of the earth—hence it is that no patients ought to be allowed to sleep lower than that from the ground. It is easy and would not be expensive to construct a building upon arches, admitting free access of air. The upper part divided into small rooms, opening into a gallery or passage, and each room well ventilated and capable of containing no more than two beds, especially where patients in fever are the occupants. The sister and nurses could have allotted to them a certain compartment where they could be at hand at any time. A building such as this could be run up at a very little expense, and if established at the distance of four or five miles would not be out of the reach of the medical officers.

It must be quite evident to any person of common sense that it is only intended that these establishments should be set apart for such patients as are required to be in the house, and as these are so much greater in number, it is for these that the greatest care is required in the selection of the most proper locality and construction.

It is not for me here to lay down the plan of a building; it is enough to state, that an unhealthy or crowded situation is improper for an hospital, and that wards containing a number of beds are at direct variance with the means intended for cure.

It may be asked, how could the eminent physicians and surgeons be expected to come some four or five miles every day to visit patients? The answer is, that they have nearly that distance to come every day in town, and the only change would be, that they would have to go the same distance out of it. Let two resident physicians, and as many surgeons, according to the extent of the establishment, be appointed, and there is as little fear that quite as much good, if not more, will be the result. We shall have the profession more open, and much less of that medical market and jobbing than now disgrace this noble occupation; where there is no chance of preferment, there is no stimulus to attainment.

These hastily-drawn observations will serve one very important purpose; they will call public attention to a subject which, at this juncture most especially, demands the consideration of all who are well-wishers to the human race, and embued with the sentiments of Cicero, "Nihil humani a me alienum puto." None can dispute the claim the subject has upon public attention, or the truth of the remarks which have hastily been made, and which, at an early period, I shall follow up by suggestions for improvements in our schools, and chirurgical instruction.

THE ROYAL COLLEGE OF CHEMISTRY, LIVERPOOL.

It is with much satisfaction that we notice the establishment in Liverpool—by our talented friend and contributor, Dr. Sheridan Muspratt—of a College of Chemistry, on the plan which for years has been pursued in the celebrated institution at Giessen, at which Professor Muspratt completed his scientific education under Professor Liebig. We hope and believe that Liverpool will at no distant period be renowned for the advancement of chemical science through this very excellent College, and its no less excellent professor.

The establishment of such a school reflects the highest credit on Professor Muspratt; and if, as we have every reason to hope, similar ones be formed in other large and important towns, it will always be remembered that to him we are indebted for the idea.

The Apothecaries' Company have refused to "recognise" Dr. Muspratt's College—we suppose, simply because they could do so if they pleased. However, this may be regarded as another step towards the self-annihilation of the authority of this Company. Indeed, it is high time that a mere trading Company of the city of London should be deprived of the power of examining and licensing medical practitioners all over the kingdom. Its jurisdiction ought to be restricted within the twenty-five wards of the city. We hope shortly to see the power transferred to fitter hands, and it is rumored that this will be done at no very distant period. It is such flagrant abuse of its arbitrary power as the refusal to recognise Dr. Muspratt as a teacher, when his certificate is received by the London University and the Royal College of Surgeons, that causes one to wonder however such tyranny has been so long endured. It is the duty of the Company rather to foster and encourage such enterprises than to discourage them. The day which shall see the authority of the Apothecaries' Company transferred to a body appointed by the Legislature will be one of hope for medical science.

We sincerely wish success to Dr. Muspratt's most laudable undertaking, and strongly recommend such of our junior readers as reside in or near Liverpool to place themselves under Dr. Muspratt for a course; and if they have any talent for investigation, science will soon be the gainer by their labors.

NEW PUFF.—THE DINNER PUFF.

It appears from the *Pharmaceutical Journal*, that the rising generation of druggists prefers dinners to lectures. It seems that at the Pharmaceutical School dinner in July, some of the late students emitted, with "much enthusiasm," some eulogies of the course of instruction adopted by the Society, and urged their brethren to pursue it. It might be worth while to get up another dinner as an excellent means of puffing. "About twenty lectures," we are told, "may be attended for the price of one dinner;" and "although the excitement (!) may not be so great at the time, the benefit is much more lasting." The "excitement!" Fie!

The editor then makes a feeling appeal to "those who have never attended the lectures to come as *visitors* for the first week;" and if they do not like the sample (not to go somewhere else), but to consider "whether they have not committed an error in selecting pharmacy as the pursuit in which they are to occupy themselves in after life"!

Now, we have no objection to make to

the lectures or the lecturers. Dr. Pereira is a very eminent man, and one of the very best lecturers, on any subject, in London; and the other two lecturers, we have no doubt, are all they are represented to be, but we do very strongly object to the puffing system adopted to induce young men to attend these lectures.

PREPARATION OF PROTIODIDE AND BINIODIDE OF MERCURY BY THE DIRECT WAY.*

BY M. D. DUBLANC.

TAKE—Pure Mercury 100
Dry iodine in powder 124
Alcohol, at 93° 1000

The mercury is put into a flask, alcohol is poured in, and iodine is added by 10 grammes at a time. When agitation has given rise to a combination, and the alcohol has resumed its transparency, the portions of iodine are added. Thus 120 grammes are absorbed. The alcohol having again become clear, the last 4 grammes are put in, and it is well shaken. This time, the liquor remains colorless, because the combination has arrived at its limit; the biniodide of mercury is made. After removing it from the flask, it must be washed with a little concentrated alcohol.

The biniodide of mercury thus prepared is crystalline; the crystals, which are very regular, have a hyacinth shade; but, by division, it assumes the aspect and state in which it is ordinarily used.

The protiodide of mercury is obtained with the greatest facility, by adding one proportion of mercury to the biniodide.

Take the quantity of biniodide of mercury obtained in the foregoing operation; or,

Biniodide of mercury 224
Mercury..... 100

Make the first mixture in a mortar, and finish the combination on porphyry. By giving the necessary time to the operation, the protiodide of mercury washed in alcohol does not contain the slightest trace of biniodide.

The advantage which the author recognises in this process of preparing the iodide over all others, and in particular over those of the Codex, is that of giving pure products; of avoiding the employment of substances whose individual juice is higher than that of the compounds to whose formation they contribute. The alcohol employed in the operation adds nothing to the expense, since it can be used over and over again.

* *Journal de Chémie Medicale*, July, 1849.

THE LATE DR. NICOL, OF INVERNESS.

IT is with much pain that we have learned that our highly-esteemed friend, the amiable Dr. John Inglis Nicol, of Inverness, fell a victim to cholera, on the 20th of September, at the age of 61. He was an occasional contributor to the former series of this work. His death has deprived the people of Inverness of a friend to whom all were warmly attached.

LIEBIG AND THE CHEMISTS' ASSOCIATION OF LIVERPOOL.

To the Editors of the Chemist.

GENTLEMEN—I was very much amused in reading the following remarks in the *Chemical Times*, copied from the *Pharmaceutical Journal*. They occurred in a lecture recently delivered on Toxicology, before the above Association. "With regard to the chemical theory suggested by Liebig, Dr. Brett considers nothing more fallacious and unsubstantiated; the supposition that every poison, whether dilute or concentrate, potent or gradual, acts by chemical combination with organic tissue, he deems absurd." Dr. Brett makes an assertion, without the slightest possible foundation; for I know he is no organic chemist, and, moreover, I am certain that this lecturer to a provincial medical school could not *analytically* corroborate or disprove any theory ever put forward by the acknowledged greatest chemist of the age. Liebig, *to whom the name of Brett is unknown*, would confer too much honor upon our toxicologist by replying to his vague notions on poisons. Take the following well-meant advice, Dr. Brett. Never allow your name to appear before the public in such a ludicrous manner. A "commercial tester," with a small amount of local fame, disputing the theories of a world-renowned philosopher! Poor human nature!

I am, Gentlemen, your obedient servant,

A FRIEND OF LIEBIG'S.

Oct. 3rd, 1849.

IV. REVIEWS, NOTICES OF BOOKS, &c.

ELEMENTS OF CHEMISTRY, THEORETICAL AND PRACTICAL, INCLUDING THE MOST RECENT DISCOVERIES AND APPLICATIONS OF THE SCIENCE TO MEDICINE AND PHARMACY, TO AGRICULTURE, AND TO MANUFACTURES. Illustrated by 230 woodcuts. Second Edition. By Sir ROBERT KANE, M.D., F.R.S., President of Queen's College, Cork; Director of the Museum of Irish Industry; Member of the Society of Pharmacy of Paris, &c., &c., &c. London: Longmans and Co.; Dublin: Hodges and Smith. Pp. 1069.

PERHAPS no man confers on the science to which his life is devoted a greater boon than he who bestows on it, in a succinct and condensed form, an epitome of the elements of which it is constituted. The labor and patience involved in the preparation of such works, and the immense expense attending their publication, have the effect of restraining their numbers within very narrow limits. Among such works the first edition of that before us has for some years held a distinguished rank, and the second edition is a great improvement on it, the author having, with laudable care, reconsidered and revised every chapter, and having, in many instances, almost re-written them, so as to include the results of all the researches in organic and norganic chemistry, and in the physical department of chemistry, which have been added to the science since the publication of the first edition.

"Chemistry," says Sir Robert Kane, "being itself but a department of natural philosophy, although the most extensive in its objects, and the most important in its uses, it is connected so intimately with the other branches of physics, that a knowledge of at least their general principles is necessary for the proper understanding of the nature of chemical phenomena. I have, consequently, embraced within the design of the present work, a description of the physical properties of bodies, as they serve to complete their chemical history, or influence their chemical relations: and thus, upon the one hand, supply characters by which chemical substances may be recognised, and, upon the other, modify the affinities by which the action of chemical substances upon each other is determined. With this two-fold object the chapters on cohesion, light, heat, and electricity, have been drawn up." Certainly these chapters are excellently written. They will be found invaluable to the student.

"That portion of the work which treats of the general laws of chemical combination is followed by an account of the mode of preparation and properties of all inorganic substances of interest to science, to medicine, or to the arts. But in this part I will pass over very briefly the history of numerous bodies, which, from their rarity, are objects only of scientific curiosity, referring those who would wish to study their history more closely to the extended works of Thompson, of Graham, of Dumas, of Gmelin, of Liebig, or Berzelius."

"In the department of organic chemistry, my object will be fully to discuss the history of all such bodies as are of importance, from their bearing upon general principles, or existing theories; from their use in medicine or pharmacy, their employments in the arts, or in ordinary life. The numerous series of which are every day discovered in organic chemistry; but which do not come under any of the above heads, shall be dismissed with only a notice of their existence."

"The relations of chemical action to the functions of organised matter, the application of chemistry to physiology and to pathology, will be treated so far as our accurate knowledge extends, and finally, a succinct description of the mode of analysis of organic and inorganic bodies will be given."

The plan thus laid down Sir Robert has carefully and ably followed out.

We select the following chapter—

"On the Preservation and Putrefaction of Animal Matters.

"From the greater complexity of composition of animal substances, their decomposition is more rapid, and its products more diverse than in the case of organic bodies of vegetable origin; and whilst the carbon, hydrogen, and oxygen give origin to the various kinds of albumen and other substances of the same class, the nitrogen is generally evolved as ammonia, and the sulphur as sulphuretted hydrogen. It is the presence of these bodies that gives to putrifying animal substances the disagreeable odor by which that process is distinguished from mere mouldering or rotting.

"Even during life the constituent particles of the body are in a continual state of change, being absorbed and thrown out of the system whilst others are assimilated in their place. Any part of our constituents

liquid or solid, which becomes unfitted for this vital function, is thereby killed, and must, if not gotten rid of, induce the death of the individual. Hence precisely the same means which give to animal substances the fixity of constitution, which belongs to true chemical compounds, and thus preserve them from decomposition by the disturbing action of their own elements (as when we coagulate albumen by an acid, by corrosive sublimate, or by oxide of copper), produce, if applied to the living body, the death of the part or of the whole being, by depriving the blood or the tissue of the mutability of constitution which is required for the functions of the animal frame.

"It is thus that the generality of metallic poisons act in producing death. Being absorbed into the system, they unite with the albumen and fibrin of the blood, and converting them into the insoluble compounds which we form in the laboratory, unfit them for the continual absorptive and secretive offices which as organs while they live they must fulfil. If the injury be local and limited in extent, the part so coagulated may be thrown off, and after a certain time the functions return to their proper order. If the mass, or the importance of the affected parts be greater, the system cannot so get rid of the portions which have thus been removed from the agency of life to submit to merely chemical laws; on the contrary, the vital powers of the remaining portions of the animal are so much weakened in the effort that the general death is caused.

"For putrefaction it is thus necessary—1st, that the force of vitality, which governs so completely the mere chemical tendencies of the elements of our frames, be removed; 2nd, that there should not be present any powerful chemical re-agent, with which the organised material may enter into combination, and thus the divellant tendencies of the affinities of its elements be overcome; 3rd, that water be present in order to give the necessary mobility; 4th, that oxygen be present, or at least some other gas, into the space occupied by which the gaseous products may be diffused; and, lastly, that the temperature shall be within moderate limits, putrefaction being impossible below 32° and above 182°.

"The efficacy of the first of these preventive powers need not be further noticed. The second is extensively employed in the preparation of bodies for anatomical purposes, by baths or injections into the arteries, of solutions of corrosive sublimate, acetate of alumina, sulphate of iron, tannin, wood-vinegar, and kreosote; this last body, however, does not appear to act by direct combination, but by the complete (catalytic) coagulation it produces in all the tissues of the body that have protein for their base. The necessity for the presence of water is shewn by the fact that by drying the animal substances, they are completely preserved. It is thus that the bodies of those perishing in the Arabian deserts are recovered, years subsequently, dried, but completely fresh. Alcohol and common salt act in preserving animal bodies by their affinity for water. If a piece of flesh be covered with salt, the water gradually passes from the pores of the flesh, and, dissolving the salt, forms a brine, which does not wet the flesh, but trickles off its surface; the water necessary for putrefaction is thus removed. The mode of strengthening alcohol in a bladder (p. 774) rests on the same principle.* Fourth, by excluding oxygen, the putrefaction process is retarded, precisely as the fermentation action of the gluten in grape juice (p. 772) cannot begin until a small quantity of oxygen be absorbed. It is thus that meat which is sealed up in close vessels, and then boiled for a moment, is preserved; the small quantity of oxygen of the air remaining then in the vessel is absorbed, and the product of that minute change being coagulated by the heat, it cannot proceed further. A high temperature stops putrefaction by coagulating the azotised materials; a temperature below 32° F. for freezing the water, acts as if the tissue had been dried; in both cases, putrefaction is arrested.

"During putrefaction, at a stage prior to any fetid gas being evolved, a peculiar organic substance is generated, possessed of intensely poisonous properties, and the blood of persons who have died from its effects is found to be quite disorganised, and irritating when applied to wounds. The blood of over-driven cattle is found to produce effects similar to those of venomous reptiles, and the wounds received in dissection are sometimes followed by similar fatal consequences. The communication of disease, in this way, has recently been very ingeniously ascribed by Liebig to the general principle of the communication of

* "A singular mode of concentrating alcohol is founded on the fact that alcohol does not moisten the animal tissues, but corrugates, and rather abstracts water from them. Hence, if a bladder be filled with spirit of sp. gr. 0·820, containing 90 per cent. of alcohol; and if it be left for a few days in a warm oven, the spirit will be found to have sp. gr. 800, containing 97 per cent. of real alcohol. The water permeates the bladder, and evaporates from the outer sides; but as the alcohol does not moisten the bladder, it cannot get through, and, consequently, it remains behind, freed from water."—Page 774.

decomposition by contact. (P. 229). The small quantity of diseased organic matter originally introduced into the system, by absorption, acts as a ferment, and re-produces itself in the mass of blood, until this becomes unfitted for the performance of its functions, and the animal is killed; the active principle being thus copiously present, is exuded from the skin and lungs, and gives a contagious character to the disease; or it remains only in the blood, or is secreted in pustules, &c., constituting infection, by which the disease may be communicated to another person.

"In the decomposition of vegetable matter, in marshes, similar maleficent products may be evolved, and throwing the blood of the animal, by which they are absorbed, into fermentative decomposition, produce the effects of malaria and marsh miasma."

We very cordially recommend this work to the notice of our readers, who will join with us in thanking the distinguished chemist, its author, for his very valuable addition to the literature of our science. No scientific library can be considered complete without it.

ELECTRICITY AS A CAUSE OF CHOLERA, OR OTHER EPIDEMICS, AND THE RELATION OF GALVANISM TO THE ACTION OF REMEDIES. By Sir James Murray, M.D., T.C. D. and Ed., M.R.S.C. Ed., Inspector of Anatomy. Dublin: James McGlashan; London and Liverpool: Orr and Co. 1849. Pp. 160.

This work is chiefly a republication of essays published by the author in the medical periodicals, and are devoted to the explanation of his views concerning animal electricity, and the effects of certain electrical conditions of the atmosphere on the animal economy.

He denies the existence of "marsh miasma," and says that, "instead of receiving such a deleterious agent into bodies to originate pestilence, it appears more certain that bodies lose, or give out, some of their own qualities of sanitary influence, the deprivation of which renders them amenable to certain scales of disordered conditions; millions of trials show that the infliction is generally of a negative not of a positive kind, in localities calculated to draw vital powers from living things."

He says, "that continued trials testify that fens, marshes, sewers, drains, cesspools, mud banks, filthy garments, wet floors, damp factories, sunless rooms, and houses near graveyards, are the carriers but not the creators of pestilential and epidemic maladies;" that is to say, "that these ready conductors convey away part of the natural atomical electric power which every particle of living matter should enjoy." The converse of this proposition holds good, "because other severe injuries and disorders are inflicted by overplus electricity."

He is further of opinion, that "all epidemics are the same character of diseases, differing only in degree, according to the extent of broken equilibrium between atomical galvanism and the living atoms to which it belongs. We cannot agree with the assertion, that any new theory of diseases may be easily accounted more rational than the best of the old ones."

"The powers of many remedies are in proportion to their action in restoring or preserving proper atomical equality of electricity."

These are some of Sir James Murray's opinions, and he brings forward, in support of them, a considerable number of facts. The opinions are unquestionably entitled to notice, and we hope that he, and indeed all who are engaged in the pursuit of such investigations, will continue with unabated zeal to enlighten the profession on the subjects embraced by this treatise.

We recommend the perusal of this work to such of our readers as are of an investigating turn of mind, and they will be so much interested in it as to put some of its theories to the test.

Sir James Murray has brought a considerable number of facts to bear on the subjects of his work.

We give the following extract, which is all we have space for this month:—

"How easily the balance of the elementary parts of our bodies may be disturbed, and the constituents changed, may be seen by considering how nearly their proximate principles approach to those of each other, and how nearly the number of ultimate elements approximates in each principle.

"Fibrine, albumen, and gelatine, respectively," says the author, "consist of

	Fibrine.	Albumen.	Gelatine.
Carbon	53·360	52·883	47·881
Oxygen....	19·685	23·872	27·207
Hydrogen..	7·021	7·540	7·914
Nitrogen ..	19·934	15·705	16·998
	100·	100·	100·

"The same laws apply to vegetable physiology and organization. The untoward derangement of vegetable principles, of late years, destroy potatoes and other succulent plants.

"The ultimate constituents of vegetable

matter are oxygen, hydrogen, and carbon, and sometimes nitrogen. All the products of fermentation must be new compounds of these three or four constituents.

"Sugar is a vegetable acid, and consists of

Hydrogen.....	6·90	} 57·53 water.	
Oxygen.....	50·63		
Carbon.....	42·47	42·47	
	100·	100·	

Yeast sets up new electrical action, disturbs the affinities of the elements of sugar, and takes its oxygen from it; the equilibrium being broken between the principles of the sugar, these so re-act on each other as to be converted into alcohol and carbonic acid.

BOOKS RECEIVED.

"The Use of the Blow-pipe, in the Qualitative and Quantitative Examination of Minerals, Ores, Furnace Products, and other Metallic Combinations." By Professor Plattner, Assay-master at the Royal Freyberg Smelting Works. Edited, with emendations, by Dr. Sheridan Muspratt, Professor of the Liverpool College of Chemistry, Author of "Outlines of Qualitative Analysis, for the Guidance of Students of Chemistry," &c. With a Preface by Baron Liebig. Illustrated by numerous Wood-cuts. London: Taylor, Walton, and Maberly. 1850. Pp. 401.

"Cholera: An Inquiry, Physiological and Pathological, into its Proximate Cause." By Protheroe Smith, M.D., Member of the Royal College of Physicians, Physician to the Hospital for Women, &c., &c. Second Edition. London: H. Baillière. 1849. Pp. 40.

"Electro-Physiology." Illustrated. By H. M. Noad. London: G. Knight and Sons, Foster-lane.

"Guide to the Alkalimetrical Chest, or Practical Instructions for the Determination of the Commercial Value of Alkalies and Acids." By A. Normanby. Illustrated with Wood-cuts. London: G. Knight and Sons.

"Practical Observations on Galvanism, Electricity, and Electro-Magnetism, as Employed in the Cure of Disease." By John Palmer Tylee. Bath: Charles Clark, Bridge-street.

"Lectures on Electricity and Galvanism in their Physiological and Therapeutical Relations, Delivered at the Royal College of Physicians." Revised and extended by Golding Bird, A.M., M.D., F.R.S., F.L.S. Longman and Co.

"A Chemical Nomenclature and Classification; to which is added an Historical Lexicon of Synonymes." By F. Hoefer, M.D. Peirce, 310, Strand.

TO CORRESPONDENTS.

"E. W. Chichester."—There is no work devoted entirely to the electric telegraph. See Lardner's "Cabinet Cyclopædia," 2 vols; and the "Specifications of the Various Patents."

"T. C. Rue."—You may make the article alluded to in small quantities, but we do not think you will save much by so doing. The duty upon the article is a great impediment to researches requiring its employment.

"Alpha."—Your questions were answered fully last month. You could not have considered the composition of the articles when you commixed them.

"Brandon."—We recommend you to procure Smee's work, but you will want much more information than is contained in that work alone. The whole of the information now possessed has not been collected into any one work. There is a vast amount of experiments and deductions diffused through the old series of this journal. The laborers in this field have been very numerous. Mr. Walker's "Electrotype Manipulations," published by G. Knight, will supply you with some useful hints.

"Wm. Storey."—We cannot answer your question fully this month. We will do so by letter as early as possible.

In answer to several correspondents, respecting the question of a supply of pure water to the public, which is now engrossing so much attention, we beg to say that we shall take an early opportunity of bringing the subject before our readers. We are glad to see that Mr. Tabberner is pursuing his objects with so much determination; the public will owe him much, let the result be what it may.

"A. B."—A solution of the fused cyanide of potassium will answer your purpose.

"An Old Friend" is informed that we will carefully inquire into the facts relative to the subject which he mentions. If it is as he thinks, publicity is the best cure.

Notice.—*All Communications and Books for Review must be addressed* "To the Publisher of The Chemist, 17, Surrey-street, Strand, London." *Communications must be pre-paid, and sent before the 15th of each month. Books for Review before the 10th,*

THE CHEMIST.

[NEW SERIES.]

I. CHEMISTRY.

GENERAL CONSIDERATIONS ON THE ELECTRO-CHEMICAL THEORY.*

BY M. BECQUEREL.

(*Continued from page* 53.)

EDMUND BECQUEREL has adduced as follows the action of gases on metallic surfaces :—

If we take a condenser formed of two plates of platinum varnished only on the sides to be placed opposite to each other, and if, after remaining some time in the air, each of them be touched with a damp finger, no effect is produced; but if one of the plates be removed and plunged for a few seconds into hydrogen gas, on replacing it and establishing the metallic communication, the condenser acquires a very considerable charge; the plate steeped in hydrogen gas takes positive electricity, that which remained in the air, or was plunged into oxygen, takes negative electricity. These two effects continue for some time.

In operating with a plate of gold and another of platinum, the gold, having for gases a less conducting power than platinum, acts like the plate of platinum covered with hydrogen.

By covering the surface of each plate not in contact with lac varnish, such a thickness is produced that on plunging one of them into hydrogen no electrical effects are obtained.

As to the results obtained by putting the plate of platinum and the plate of zinc in metallic contact, the latter not being covered with condensed oxygen, since the layer of oxide formed is opposed to it, should act like platinum plunged in hydrogen, and acquire, consequently, positive electricity. In establishing the communication with moistened fingers, the zinc is oxidised and takes negative electricity.

It remains to be explained how it is that when two platinum plates have been immersed, one in oxygen and the other in hydrogen, they take a charge of contrary electricity. This explanation may be made by admitting, with De la Rive, that oxygen always tends to oxidise platinum in one case, and hydrogen, in the other, to reduce the oxide formed.

This view is not opposed to known facts, since it is known that an infinitely feeble chemical action produces appreciable static effects. I proved effectually that the oxidation of a quantity of hydrogen capable of giving 1 milligramme of water disengages sufficient electricity to charge twenty thousand times an armed surface of 1 mêter superficies, and giving sparks at a distance of 1 centimeter; thus, one milligramme of platinum, in oxidising, would give nearly two thousand charges of the same intensity. According to a very simple calculation, it is deduced that the oxidation of $\frac{1}{10000}$ of a milligramme of platinum would be sufficient for charging the condenser two thousand times. There is, therefore, no reason why we should not attribute the electrical effects produced, when the surface of the platinum has condensed the oxygen, to the oxidation of that metal.

The principles which I have just explained are those which I have constantly professed since I have studied electro-chemistry; the objections which have been made to them, and the experiments in support of them, could not modify them, as we shall see.

Berzelius, who had long admitted the electrical effects produced in chemical actions, as may be seen in the first edition of his "Treatise on Chemistry," returned, in the second French edition of that work, to Volta's theory, without even admitting, as

* *Annales de Chimie et de Physique*, Sept., 1849.

Davy did, the intervention of chemical action in the charge of the pile.

This change of doctrine must be attributed to several causes:—1st, to the existence, according to him, of the catalytic force; 2nd, to the relations which he supposes to exist between the effects of this force and the electrical effects of contact; relations of such a nature that contact, by changing the electrical state of atoms, is capable, in certain circumstances, of destroying the combination and forming new ones; 3rd, to the mathematical theory of Ohms, generally adopted in Germany, where more attention is paid to systematic views concerning the causes of the disengagement of electricity than to experiments having the object of determining the causes of the disengagement of electricity in general. The natural philosophers who have made a profound study of this question have rejected the electro-motor force of Volta as being insufficient for explaining the numerous facts with which electro-chemistry has been enriched during thirty years.

I will add a few words on the ideas of Berzelius on the catalytic force, which are connected with those which he enunciated touching the relations which connect affinities with electrical forces.

The catalytic force is that which is manifested on the contact of certain bodies with other bodies, and from which a certain chemical action results. Sometimes combinations are destroyed, and sometimes others are formed, without the bodies which produce these effects undergoing the slightest change in their constitution.

Spongy platinum excites an action of this kind with respect to the detonating mixture (1 vol. of oxygen and 2 vols. of hydrogen). At the instant when the spongy platinum is put into the gaseous mixture, there is a disengagement of heat and light, and a production of water. This same spongy platinum, moistened with alcohol causes its oxidation and converts it into acetic acid.

It sometimes happens that bodies which enjoy a similar property, are themselves altered or destroyed; as sugar, which is converted, in presence of yeast, into alcohol and carbonic acid.

Berzelius admits that the catalytic force acts in a more general manner in organised, and especially in living bodies, where we see the same juice give rise to a multitude of products, of which we cannot explain the formation, unless by supposing that the solid parts determine in different points different transformations between the constituent parts of the liquid which circulates in the different parts of the living body.

The existence of the catalytic force being once admitted, Berzelius gave it an origin to which we very commonly have recourse when we have to explain the effects of an occult force. He returned then to the electrical effects of contact due to an electromotive force which he had abandoned, at least in great measure, when my first investigation concerning the electrical phenomena produced in chemical actions appeared, which were in their turn sacrificed to the catalytic force. The assimilation of the catalytic force to the force which engenders the electrical effects of contact did not appear possible, because the latter manifests its action only when bodies are good conductors of electricity; whilst the former does not require this condition. It is known that pummice stone, porcelain, glass, &c., determine, like spongy platinum, although at a higher temperature, the combination of oxygen and hydrogen in the detonating mixture.

Berzelius, having rejected all molecular action as a cause of electrical effects of contact, sought to demonstrate the existence of the electro-motive force: unfortunately, the experiment which he adduced in support of his opinion leads to a consequence favorable to the electro-chemical theory, instead of being opposed to it. A pile was constructed for this purpose with a certain number of pairs, composed each of a disc of zinc, of a disc of copper, and of two solutions, one of which, that in which the zinc was immersed, did not attack that metal, and the other, on the contrary, acted powerfully on the copper. This arrangement was adopted in order to prove, that if the oxidation were the cause of the disengagement of the electricity, the copper should be the electro-positive element, and the zinc the electro-negative, in which case the poles would be reversed. To fulfil these conditions, a long bent appendix is fixed to the copper disc, and soldered at the other end to the edge of the zinc disc, of the same dimensions as the other. Both discs are plunged horizontally into two glass vessels of equal height, placed side by side. These pairs are arranged in such a manner that the zinc disc of each metallic pair occupies the lower part of a vessel, and the copper disc the upper part of the contiguous vessel. A solution of sulphate of zinc, boiled with zinc filings in order to render it as neutral as possible, is poured at the bottom of each vessel, until the level is found at half the height comprised between the zinc and copper discs. Commercial nitric acid is made to flow gently on this solution by means of a funnel, taking care not to mix the liquids, and in sufficient quantity to cover the copper discs. These two liquids are in separate layers; so

long as the circuit is open, the copper is powerfully attacked by the nitric acid, and there is an abundant disengagement of nitrous gas. As soon as communication is established between the two extremities of the pile, the copper ceases to be attacked by the nitric acid, and there is deposited on the sheets of zinc a film of oxide of that metal; the nitrate of copper formed in the first instance is decomposed, and copper is deposited in the metallic state on the plate of the same metal. The electric current is energetic, and directed from the zinc to the copper through the solutions. On interrupting the circuit, the first effects are reproduced, that is to say, the copper is attacked by the nitric acid. From this Berzelius concluded that the chemical combination of oxygen with copper cannot be the cause of the electrical effects produced, since the combination ceases to take place as soon as the circuit is formed, and that thence the effects produced must be attributed to the contact of the zinc and the copper.

This experiment, so far from upsetting the electro-chemical theory, as Berzelius conceived, is calculated, on the contrary, to afford to it support. Indeed, if we substitute for the copper and zinc discs, discs of platinum or gold, which are not attacked by the two liquids, and which do not produce electro-motive force, we have a current driven in the same direction, which is owing to the re-action of the nitric acid on the sulphate of zinc; during this re-action, the acid gives out positive electricity, and the solution of sulphate of zinc negative electricity. Berzelius overlooked this re-action, whose electrical effects are predominant. In operating with sheets of zinc and copper, there are, then, two currents impelled in different directions—one arising from the re-action of the two solutions on each other, and the other from the action of the nitric acid on the copper; the result is equal to the difference of the two currents.

Now I formerly proved that when copper is violently attacked by nitric acid—a liquid of excellent conducting power, on account of its easy electro-chemical decomposition—the greater part of the two electricities disengaged is re-combined in contact with the metal and the acid, whence it follows that the current due to the reaction of the two liquids overcomes the other; the copper then becoming negative, is no longer acted on by the nitric acid. The effects produced are, therefore, explained without any difficulty in the electro-chemical theory, whilst they could not be by that of contact. It is then proved by this, that if it be desired to throw aside the bases of an electro-chemical theory, it is necessary previously to analyse the very various electrical effects to which chemical actions and molecular actions give rise. In general, we neglect, in the appreciation of facts, to take account of the effects produced in the re-action of solutions on each other, and of re-composition of the natural fluid on contact, when the active liquid is a better conductor than the other liquid parts of the circuit. This omission is the cause of most of the errors into which experimenters have fallen. I return to the electric polarity of atoms connected with the question.

Berzelius, in the second (French) edition of his *Traité de Chimie*, again supported the electric polarity of the atoms, relying on some facts and the considerations which I am about to detail.

This polarity, which he regards as proper to the matter, and scarcely appreciable in ordinary cases, is rendered sensible, according to him, in indifferent bodies by friction, heat, and induction. Hence, he infers that, since it manifests itself in masses it should likewise exist in the ultimate particles of bodies.

In contact, the polarity of simple or compound atoms increases, either because some of them take contrary electricity, or because the opposite electricities are neutralised. This hypothesis is not supported by any fact, however trifling, seeing that, in the first place, contact disengages electricity only when there is a molecular action; and, in the second, that the electric polarity developed in the friction of two bodies cannot be compared with that supposed to exist in simple atoms—two essentially different orders of facts. Other difficulties than those I have named oppose the admission of electric polarity. Berzelius admits, for example, that atoms have a spherical form; but, if this be the case, where would these poles be? He foresaw this difficulty, but he has not endeavored to get rid of it. As to the increase of force which the polarity of atoms acquires by heat, and its identity with that of tourmaline, I have already shown that this comparison is not possible, and that it should be rejected. The following experiments, which Berzelius made, to prove that atoms possess two poles of contrary name not having the same intensity, lead to a conclusion opposed to his. When we pass the inflamed vapor of potassium, consisting of potassa, a very electro-positive oxide, between two small spheres charged with contrary electricity, this vapor, according to Berzelius, instead of flowing away, is attracted by the sphere charged with negative electricity, and repelled by the other: when phosphorus is the body in combustion, the

phosphoric acid is attracted, on the contrary, by the sphere charged with positive electricity, on which it is deposited. Hence the conclusion, that the small particles of potassa and of phosphoric acid must contain, the first, an excess of positive electricity; the second, an excess of negative electricity, and that, consequently, the atoms have a preponderating electricity. But it must be said, in the appreciation of facts, Berzelius did not guard against the causes of error which are frequently met with in experiments of this nature; to prove it I will point out the electrical effects produced when vapors in general are submitted to the action of an electrised body.

When we disengage, near a conductor charged with a powerful excess of positive or negative electricity, vapor arising from the combustion of phosphorus, sulphur, resin, or potassium, operating in a vessel of glass, or of non-oxidisable metal, there is always attraction on the part of the conductor, which is so much the more powerful as the conductor is more charged with electricity. The vapor, therefore, acts simply as a conductor, and not as a body possessing an excess of free electricity; but, when it is very near the conductor, it is repelled when it receives from the latter more electricity than it can carry off with it. Moreover, when the vapor is nearer to one conductor than to the other, being attracted by the first, it seems to be repelled by the other. The non-electric state of the vapor is demonstrated as follows:—Over the vapor is placed a glass tube, perfectly dry, and, consequently, a good isolator; the vapor condenses on it; if it were electrical, the tube would be so likewise; but it is not so, as may be proved by presenting it to the small electrised disc of Coulomb's electroscope. The facts detailed by Berzelius are not, therefore, correct.

I think I have completely refuted, relying on indisputable facts, the arguments advanced for demonstrating the electric polarity of atoms, and the difference in the electric intensity of each pole.

I will not follow Berzelius in the arguments he has entered into for proving the consequences which flow from this theory, since the bases being inadmissible these arguments could possess no scientific interest. I will confine myself to saying that he attributes an electrical origin to heat and light, regarding them as the result of the passage of an electric current in conductors which offer resistance to it. But, if heat really were formed of the re-union of the two electricities resulting from polarity, this polarity would cease at the instant the combination was effected, and then how could the atoms remain in contact? It is impossible to reply to this objection when we wish to make affinities depend on electrical forces, if we do not admit the permanent electrical state of atoms with electrical atmospheres.

Several natural philosophers have recently sought, like Berzelius, to revive Volta's theory, but as they have not taken account, in the examinations they have made of the electrical effects of contact, of the numerous causes which contribute to their production, and whose origin is chemical, calorific, or mechanical, it follows that the consequences which they have deduced cannot be admitted.

In analysing the electrical effects produced in the contact of solids and liquids, we must take into consideration—

1st. The conducting power of liquids for electricity.

2nd. The thermo-electrical effects produced by the heating of plates of metal steeped in liquids which act on them.

3rd. The electrical effects due to the reaction on liquids of foreign bodies adhering to the surface of the plates.

4th. The electrical effects resulting from the re-action of solutions on each other, and of the solution formed on the surrounding liquid; thus, when a plate of copper is immersed in nitric acid, as soon as the chemical action has commenced, the metal takes an excess of negative, and the acid an excess of positive electricity. The nitrate of copper, immediately on its formation, re-acts on the nitric acid, which surrounds it, whence result such electrical effects that, by closing the circuit with a strip of platinum or platinum wire, we have two currents passing in the same direction, whilst the acid takes the positive electricity in its contact with the solution of nitrate of copper, as it forms, and whilst this same acid liberates this same electricity in its re-action on the metal.

If we neglect, in the interpretation of phenomena, any of the effects which I have pointed out, we run the risk of not arriving at their true origin. I will give some examples of this. Matteucci (*Annales de Chimie et de Physique*, 3e série, t. xvi., p. 257) endeavored to prove, by the following experiments, that we had not hitherto regarded in their true light the electrical phenomena produced in chemical actions.

First Experiment.—A porous-clay vessel was filled with a solution of potassa, and placed in a saturated solution of sulphate of copper. In the first was placed a bar of amalgamated zinc, and, in the second, a platinum plate: a constant pair was thus formed. The two plates were connected with a galvanometer, by means of metallic

wires; the magnetic needle was deflected a certain number of degrees. On passing a current of chlorine, bromine, or iodine, into the solution of potassa, containing the amalgamated zinc plate, in order that it might be more powerfully attacked, no trace of reduced copper was found on the platinum; or, if any were deposited, the quantity was by no means equivalent to that of the metal dissolved by the chlorine, bromine, or iodine. Matteucci concludes from this that, in the re-action of one of these three bodies on zinc, no electricity is disengaged. I may remark that one of these three bodies should combine with the potassa rather than with the zinc, by virtue of stronger affinities. Thus the zinc should not be attacked more powerfully in the second case than in the first; the conducting power of the liquid should only be a little modified. There were, therefore, no reasons for the electrical effects being much changed. On substituting for the alkaline solution a solution of neutral salt, Matteucci found that it was still the same. To explain this, it is necessary to analyse the phenomenon; at the same time, it will be seen why the action of a simple body on zinc does not cause, in this case, an appreciable disengagement of electricity.

Second Experiment.—A pair, formed of two plates of copper and amalgamated zinc, the copper plate being immersed in a capsule filled with a solution of sulphate of copper, and the zinc plate in a solution of nitrate of potassa, the two capsules being put in communication by means of a tube filled with the same solution of nitrate of potassa, and the two plates with a multiplier. There was an immediate production of two currents; one due to the re-action of the two solutions on each other, which was produced evidently by operating with two plates of platinum, and which passes from the nitrate to the sulphate; the other, arising from the oxidation of the zinc, and going from the metal to the liquid in which it was immersed, travelling, consequently, in the same direction as the first.

The quantity of copper reduced can be equivalent to that of the zinc consumed only so far as the electricity disengaged in the oxidation of the zinc is totally converted into current. Now this takes place only in the case in which the zinc is attacked when the circuit is formed; it is then only at the expense of the oxygen, and of the sulphuric acid resulting from the decomposition of the sulphate of copper. The electro-chemical action must, therefore, be in definite proportion. But if the zinc is attacked when the circuit is open, a portion of the electricities disengaged again forms neutral fluid in the solution of nitrate at the very points at which the disengagement takes place, and then the decomposition could not take place in definite proportion. I will give an example of it:—When a pair, consisting of copper and amalgamated zinc, is immersed in water slightly acidulated by sulphuric acid, hydrogen is disengaged only at the copper plate; but if the quantity of acid be increased, the disengagement of gas takes place not only on this plate, but also on the surface of the amalgamated zinc, and, in this case, the quantities of zinc consumed, and of hydrogen disengaged on the copper, are not in atomic proportion. All the electricity disengaged is not transformed into current, because there is a re-formation of natural fluid round the plate of zinc. An effect of this kind is produced, when chlorine only is made to come in contact with the zinc.

By making the chlorine act on the zinc, in the second experiment, an effect is produced, of which the following experiment will give the explanation.

(*To be continued.*)

NOTE ON THE SO-CALLED DUMB-BELL-SHAPED CRYSTALS OF OXALATE OF LIME.

BY THORNTON J. HERAPATH, ESQ.

During the microscopical examination of the urine of patients, possessed of what is termed the oxalic diathesis, physiologists have occasionally noticed the presence of certain very remarkably-formed crystals, at sometimes accompanying, and at others entirely replacing, the ordinary well-known octoëdra of oxalate of lime. These crystals have been described by Dr. Golding Bird,* by whom, I believe, they were first observed, as being "shaped like dumb-bells, or rather like two kidneys, with their cavities opposed, and sometimes so closely approximating as to appear almost circular, the surfaces being finely striated." From the circumstance of their being met with only in this disease, they have been generally considered to be composed of oxalate of lime—to be, in fact, a mere modification of the common octoëdron. If we except, however, those of their discoverer, Dr. Bird, which are, themselves, far from being conclusive, few or no experiments have been made that would prove the correctness of this opinion; con-

* *London Medical Gazette*, 1842; also, "Urinary Deposits," p. 127.

sequently, the following brief account of some which I have myself performed, with the view of determining this point, may not be deemed superfluous.

The urine, containing the crystals examined, was passed by Mr. W——, of this city, a patient of my brother, Dr. W. B. Herapath, by whom it was kindly forwarded to me early in the month of last January. This specimen was admirably adapted for such an investigation, inasmuch as the true octoëdral crystals of the oxalate were present but in very small numbers, and, therefore, could not interfere much with the re-actions of the tests.

The plan of my operations was as follows:—

A quart of the freshly-voided urine was gently heated, so as to re-dissolve any crystals of urate of ammonia that might have been formed, and produce a more perfect precipitation of the oxalates, &c.; and it was then allowed to remain undisturbed for some ten minutes or a quarter of an hour, when the clear supernatant liquid was drawn off by means of a pipette, and the light flocculent precipitate collected on a tared filter of white light paper. This, after being repeatedly washed with warm water, and dried at a temperature of about 300° F., was found to have increased in weight nearly six and a half grains. The crystals of the supposed oxalate, however, represented comparatively only a very small proportion of this, the great bulk of it consisted of albuminous matters, and the earthy phosphates. In order to get rid of the latter, the precipitate was digested in hot diluted acetic acid, and afterwards again well washed with water. Upon now boiling the residue in dilute nitric acid, the dumb-bell shaped crystals, which were unacted upon by the acetic acid, were dissolved. The acid solution thus obtained, when supersaturated with ammonia, furnished a light, white-coloured precipitate, which was soluble in the nitric and hydrochloric acids, and was unacted upon by potash, and which, when examined on the field of a microscope of high power (a Ross's one-twelfth), was found to consist of beautifully-formed rhombic octoëdra, perfectly similar in character to those of oxalate of lime, as ordinarily met with in urine.

The entire solution having been evaporated to dryness, the residue was heated to redness upon a piece of platina foil; it first turned black, and, upon a further application of heat, left a white ash, which readily dissolved, with effervescence, in the diluted acids. When tested in the usual manner with oxalate of ammonia, &c., the acid solution thus obtained afforded all the reactions of lime. There were also exceedingly minute traces of magnesia, most probably introduced by a little adherent triple phosphate, left undissolved by the acetic acid.

From the result of the preceding experiments, I think, therefore, we are perfectly justified in concluding that these peculiarly-formed crystals are really composed of oxalate of lime, and not of the oxalate of magnesia, as some of my friends were, at one time, inclined to believe.*

Old Park, Bristol, Oct. 5, 1849.

SEPARATION OF ALUMINA FROM IRON, ETC.†

BY DAVID ZENNER.

I was occupied with some analytical experiments, which, when completed, will be the subject of a separate paper, when Mr. James Nixon suggested the following method of separating alumina from iron. I undertook to make the necessary experiments, which proved perfectly satisfactory, as will be seen from the subjoined analyses.

The old method, by means of caustic potassa, is not only very tedious, but, for the most part, incorrect, even in the hands of the best manipulators. The latter defect was indeed so much felt that Dr. R. Fresenius was induced to investigate the cause of it, and proposed some remedies. The principal disadvantage was that the caustic ley can scarcely be obtained and kept free from organic matter, which makes the ley capable of dissolving small quantities of oxide of iron when boiled with it.

The difficulty of judging from the appearance of the color, when, on boiling such a mixture, the alumina is perfectly separated from the oxide of iron, is another important disadvantage, as, when the separation has proceeded to a certain extent, the color differs very little from that of pure oxide of iron, although it may still contain much alumina. When it is boiled for a long time with a great excess of caustic alkali, in a porcelain or glass vessel, it is

* As a further proof of the truth of this conclusion, if such be required, I may observe that I have now before me a specimen of these crystals prepared artificially, by slowly evaporating a solution of oxalate of lime in nitric acid. The remarkable dumb-bell character is extremely well marked, and they differ in no respect whatever from the natural ones above described, except in being of a somewhat larger size.

† Fresenius gives a similar method for the separation of *chromium* from iron.

very apt to act on the vessel, dissolving some silica or alumina, which are very often also among the impurities of caustic alkali, and derived from the lime used in preparing it.

The method which I am about to describe is free from all these disadvantages; the theory and execution of it are very simple, and founded on the fact mentioned in chemical books, that the peroxides of aluminum, chromium, iron, &c., give soluble salts, with tartaric and citric acids, which are not precipitated by an excess of caustic ammonia, but when sulphuret of ammonium is added to such a tartaric solution, made alkaline by ammonia, the peroxide of iron is decomposed and precipitated as sulphuret of iron, and the alumina remains in solution, and may be filtered off.

I found it advantageous to add to the muriatic solution of alumina, peroxide of iron, etc., in a beaker-glass, a neutral solution of tartrate of ammonia, and then caustic ammonia, until it was distinctly alkaline; if it becomes turbid, more tartrate of ammonia must be added, until all is perfectly dissolved; and the sulphuret of ammonia may now be poured into the clear ammoniacal solution until it predominates, and the smell of it is strongly perceptible. It is now heated on a sandbath to produce a better collection of the sulphuret of iron, and filtered off, and washed perfectly with hot water, to which a little sulphuret of ammonium, and, at the commencement, some tartrate of ammonia has been added; the latter is necessary for effecting the perfect removal of the alumina, which, otherwise, would not take place. The Analyses No. 1 and 2 show, for this reason, a slight excess of oxide of iron, which is not in the others where this precaution was used. The sulphuret of iron is to be converted into peroxide, and estimated as generally. The filtrate must be evaporated to dryness, and heated in an open platinum crucible to redness, to drive off the volatile salts of ammonia, and to destroy any organic matter; the weight of the residue gives the quantity of alumina, or oxide of chromium, if only one of them be present. When both are present, the separation may be effected by dropping some nitre and carbonate of soda into the crucible, and heating to fusion, which, by converting the oxide of chromium into chromic acid, admits of a perfect and speedy separation.

That which has been said, referring to iron, applies equally to several other metals, such as manganese, cobalt, and others.

The following are some of the analyses made. The iron used was piano-wire; the alum used contained 11·81 per cent. of alumina, the mean of three careful estimations, and the oxide of chromium from a sample of chromalum, which gave me three estimations, the respective numbers 15·42, 15·53, and 15·70 per cent., and, as a mean, 15·55 per cent. oxide of chromium. Weight in grammes, (1 gramme = 15·434 grains).

		I.	II.	III.	IV.	V.
Used	Iron..	0·018 Grms.	0·1703	0·285	0·025	0·426
	Alum	2·808 —	1·658	1·793	3·872	0·283
Calculated	Fe^2O^3	0·0257 —	0·243	0·4071	0·0357	0·6086
	Al^2O^3	— —	—	0·2117	0·4572	0·0335
Obtained	Fe^2O^3	0·029 —	0·251	0·406	0·033	0·610
	Al^2O^3	not estimated.		0·218	0·461	0·037

Many more analyses were made by different gentlemen, who have always succeeded, even when only verbally instructed, without any practical assistance.

Note.—To prepare pure alumina, it is very often recommended to heat ammonia alum to a strong red heat; but when, for the above purpose, I exposed a choice sample of commercial ammonia alum in a platinum crucible until it lost no more of its weight, the residue amounted to 18·60, instead of about 11 per cent., and on examination I found it to contain soda and potassa. This method should, therefore, be used with precaution.

Newcastle-upon-Tyne,
15th Oct., 1849.

ON THE PRODUCTION OF ETHERS, BY THE ACTION OF POTASSA ON THE BALSAMS.*

BY PROFESSOR E. A. SCHARLING, OF COPENHAGEN.

On the 19th of January, 1849, the author communicated to the Royal Danish Academy of Sciences a preliminary statement of some experiments made with the view of producing ethers, by acting with potassa on various natural balsams. After having noticed the earlier investigations concerning balsam of Peru, he observes that the for-

* From the *Chemical Gazette*, No. 169, Nov. 1, 1849.

mula given by Frémy, for the composition of cinnameïne $C^{54}\ H^{26}\ O^8$, may be looked upon as 2 $(C^{16}\ H^7\ O^2) + C^{22}\ H^{12}\ O^4$, of which the first member represents the formula for cinnameïne given by Plantamour; and the second, that for cinnamic ether, which the same chemist formed from balsam of Peru. Plantamour, however, having used alcohol in his investigation, doubts might arise as to whether this might not have caused the production of the cinnamic ether. The author subjected 1 part of balsam of Peru and 2 or 3 parts of a solution of potassa, of sp. gr. 1·3 to distillation, after the mixture had been left for 24 hours. The product consisted of water and two oily bodies, one lighter, the other heavier, than water. By drying and re-distillation, the heavier liquid was obtained perfectly transparent, of high refractive power, of sp. gr. 1·03: its boiling point was 401° F. Immediately after the distillation the smell was faint, but after having been left for some time, it became aromatic, like that of cinnamic ether.

When immersed in a refrigorating mixture of snow and common salt, the whole remained liquid at 5° F. The lighter oily liquid boiled at about 356° F.; its sp. gr. was less than that of water; its odor not unlike that of aniseed; its taste sweetish and aromatic. Cooled to 5° F., the greater part of it congealed. Both these liquids were altered by distillation; for when heated even in an oil-bath, they acquired a light, yellow color before beginning to boil. As both these presented great resemblance to cinnamic ether and peruvine, Professor Scharling endeavored to determine their identity with those substances by treating them with hydrate of potassa. Although the discoverer of xanthogenic acid, the late Professor Zeise observes that ether and sulphuret of carbon, with hydrate of potassa, do not give xanthogenate of potassa, still it was presumed that this salt might be produced by treating compound kinds of ether with hydrate of potassa and sulphuret of carbon. As this supposition has been fully confirmed with different kinds of ether—acetic ether, for example—the author mixed separately both the liquids produced from balsam of Peru with powdered hydrate of potassa and sulphuret of carbon. In both experiments the mixtures congealed; and when samples of the saline mass, dried between bibulous paper, dissolved in water, and tested with salts of copper and lead, they yielded yellow xanthogenate of copper and white xanthogenate of lead. Hence, no doubt can exist that the liquid of higher specific gravity contains cinnamic ether, obtained, for the first time, without any addition of alcohol. Whether the lighter liquid is peruvine, or a mixture of peruvine and cinnamic ether, the author hopes to be able to show in a future paper.

By distilling the solution of potassa which had been separated from the cinnameïne, only traces of an oily liquid were obtained; the rest of the distillate was only water. It is, therefore, evident that, even at the ordinary temperature, and by the influence of a solution of potassa, the combination, which at a suitable temperature is converted into a species of ether, is decomposed. In distilling balsam of Peru, as is known, no oil or ether is formed. As this might arise from the boiling point of cinnamic acid being too high, the author distilled a portion of balsam with a solution of a mineral salt, and a smaller portion of balsam with a concentrated solution of chloride of zinc. The last distillation was performed by dropping the balsam by degrees into the boiling solution of salt. By this process, besides water, some cinnamic acid, and a very small quantity of two brownish oily bodies, one of higher, the other of lower sp. gr. than the water, were obtained. Each had an empyreumatic odor; when boiled with water, a quantity of crystals of cinnamic acid were obtained by cooling. The author found no trace of cinnamic ether in this distillate. By subjecting the balsam to dry distillation, several oily liquids, containing a large quantity of cinnamic acid and water, were obtained. The cinnamic acid crystallised on cooling, and was collected on a filter; the liquid which had passed through, after having been dried over chloride of calcium and re-distilled, was treated with powdered hydrate of potassa and sulphuret of carbon.

A portion of balsam of Peru was next operated on with a solution of carbonate of soda. The aqueous solution obtained behaved like a solution of cinnamate of soda. The remaining substance was dried, dry carbonate of soda was added, and the mixture submitted to destructive distillation. The product resembled in appearance the products of the dry distillation of balsam of Peru, but traces of xanthogenic acid were found in it. From these experiments, therefore, it is not to be concluded that cinnamic ether pre-exists in the balsam, but that it is most probably formed by the action of powerful bases.

E. Simon's researches concerning liquid storax have made us acquainted with a body which he calls styracone. Professor Scharling proved that, when he treated liquid storax in the same way as he had done balsam of Peru, he immediately obtained a dis-

tillate, from which, after standing for some time, a body separated, possessing all the characters assigned by Simon to styracone. It readily dissolved in alcohol of sp. gr. 0·851. By treating styracone with powdered hydrate of potassa and sulphuret of carbon, xanthogenate of potassa was formed amongst other products. Hence it is supposed that styracine constitutes a compound ether, and the author means to investigate it more minutely. From want of styrole, he examined how benzole would act with hydrate of potassa and sulphuret of carbon. No xanthogenate of potassa was produced. Balsam of copaïba was next treated with hydrate of potassa, and then distilled. A considerable quantity of oil, which floated on the distilled water, was immediately obtained. When the water had been poured back, and distilled a second time, the quantity of oil collected constituted about 5 oz., and the distilled water about four times as much. 1lb. of balsam and 1½lb. of solution of potassa (sp. gr. 1·25) had been employed. The oil did not appear to differ from that of balsam of copaiba which occurs in commerce; but on treating these oils with hydrate of potassa and sulphuret of carbon, no formation of xanthogenate of potassa was observed. Copaïric acid, however, not being of a volatile nature, the author has not given up the hope of producing an ether by the action of a solution of potassa from this balsam by a modified process. On treating Venice turpentine in a similar manner, an oily liquid was obtained, which, when dried over chloride of calcium or lime, did not seem to be acted on by powdered hydrate of potassa. For several hours, after adding the potassa, the color of the liquid remained unaltered and without change of temperature. On adding sulphuret of carbon, a white saline mass was formed after some time, which gradually caused the whole mixture to congeal into a jelly, which, after 24 hours was thrown on a filter; when the greater part of the liquid had run off, the residue was most carefully pressed between paper. A part of the saline mass thus obtained was dissolved after being dried; another portion was shaken with ether, in order to remove all adherent oil and resin. The ether was separated by filtration, and the saline mass, after being dried, was likewise dissolved in water. Both these solutions immediately produced brown precipitates with dichloride of copper, but which in time became yellow.

With nitrate of lead, whitish yellow precipitates were formed; and with several other solutions of salts, similar re-actions to those produced by xanthogenic acid, except that all the precipitates had in general a rather darker color. This circumstance led to the supposition that an ether had been formed by the action of potassa on Venice turpentine. The boiling-point of the distillate was about 307° F.; its specific gravity 0·87; the solubility in alcohol of 0·823 sp. gr. was identical with that of common oil of turpentine.

These properties agree so nearly with those of common oil of turpentine, that the supposition of the liquid being a species of ether was abandoned; whereas it was presumed that if Venice turpentine were distilled with water, the oil obtained would exhibit the same relations to hydrate of potassa and sulphuret of carbon as the above-mentioned liquid. This was verified by experiment. Common oil of turpentine, recently distilled and well freed from water, was treated as above. The results, upon the whole, were the same; consequently, it is possible to produce, by the action of hydrate of potassa and sulphuret of carbon, from pure turpentine oil, a compound greatly resembling xanthogenic acid. But in order to form this substance, it is absolutely necessary to have well fused hydrate of potassa; because in the state in which it is often met with in commerce it contains too much water. The whole of the oil of turpentine cannot be decomposed by the sulphuret of carbon and the hydrate of potassa. The same appears to occur in this decomposition as in the production of terpine; only part of the oil of turpentine enters into the new combination.

Professor Scharling observed, that though it is asserted that all pure oil of turpentine consists only of C^{10} H^8, and that the boiling point and sp. gr. are alike; yet the oil from Venice turpentine appears in several respects to differ from the common oil of turpentine. Thus the last mentioned oil is speedily colored by the hydrate of potassa, which is not the case with the oil of Venice turpentine. The latter oil polarises light to the left; but only a rotation of 25° is required to produce the violet color. The same is the case with a saturated solution of hydrochlorate of dadyle in alcohol when the dadyle has been prepared from Venice turpentine.

Common oil of turpentine also polarises light to the left; but to produce the violet light a rotation of 70° is required. This also happens both with a saturated alcoholic solution of hydrochlorate of dadyle prepared from common oil of turpentine, and the liquid part of that oil of turpentine from which the compound resembling xanthogenate of potassa had been produced. The longer the oil of turpentine has been kept, the more powerfully is it acted upon by the hydrate of potassa. It is owing to this circumstance that at times it produces an increase of tem-

perature of more than 108° F; these form a light brown gelatinous mass, which appears in great measure to prevent the production of the compound resembling xanthogenate of potassa. Even when common turpentine, recently rectified and dried over lime, is employed for the preparation of this salt, a much darker product is generally obtained than with oil from Venice turpentine. By allowing the saline mass, which in general contains potassa and sulphuret of potassium, to remain exposed to the air, the substance becomes clearer, and the precipitate produced by sulphate of copper becomes yellow much sooner.

The author has not yet succeeded in obtaining the compound resembling xanthogenate of potassa from terpine, whether it can be prepared from terpinole he has not hitherto had any opportunity of ascertaining. He intends to make similar experiments with several other essential oils, the result of which will be communicated hereafter.

INVESTIGATIONS ON ELECTROLYSATION.*

BY M. JULES BOUIS.

In the work which I have the honor of submitting to the judgment of the Academy, I have endeavored to call the attention of chemists to the influence of temperature in electro-chemical decompositions. With the same number of elements of a pile, we may, at will, produce different phenomena of decomposition, according as the apparatus is maintained at the ordinary temperature, or heated. By passing an electric current through a solution of chloride of potassium, Kolbe was enabled to convert the chloride into chlorate of potassa, and even into perchlorate. This experiment, repeated with more or less concentrated solutions, with currents of different intensities, and whose action was continued for forty-eight hours, has constantly yielded me hypochlorite of potassa. I have shown that the difference which exists between Kolbe's results and mine must be attributed to the temperature of the liquid.

Indeed, in his valuable investigations on the hypochlorites, Gay-Lussac proved that hypochlorite of potassa, heated with chloride of potassium, converts the latter into chlorate. We know, moreover, that whenever a liquid is decomposed by a voltaic current, the temperature is raised, and the intensity of the current may be sufficiently powerful to make the liquid boil. Setting out from these principles, I passed a current into a solution of chloride of potassium, contained in a small apparatus; the presence of hypochlorite was immediately manifested, and the temperature was very rapidly raised. In examining the products formed, I detected chlorate of potassa. If now I add that the same operation was performed on an equal quantity of chloride, by making a current act, presenting equal intensity, at the commencement of the experiment—if I observe, moreover, that, in this case, I have cooled the apparatus, and that I have been able to obtain only hypochlorite, I conclude that the temperature has interfered in the re-action.

In this manner I have been able to explain many contradictory results.

Iodide and bromide of potassium are readily converted into iodate and bromate of potassa.

I have given the description of a small and very simple diaphragm apparatus, by means of which the products of decomposition may be separated at either the negative or positive pole. By means of this apparatus I was able to separate hydroferrocyanic acid and Prussian blue from yellow prussiate of potassa, and to convert, at will, red prussiate into yellow prussiate, and *vice versâ*.

Neutral chromate of potassa was in the same manner converted into bichromate, and this into chromate.

In my experiments I made use of Bunsen's battery, as modified some months ago by Deleuil. This improvement consists, as is known, in placing the charcoal internally, in diminishing, by this means, the consumption of nitric acid, and, by increasing the quantity of sulphuric acid, rendering the battery more constant. After some days' use, I remarked in the batteries a considerable diminution of intensity. The cause of this loss, which it was easy to foresee, was found in the manner of fixing the fittings to the charcoal. The pieces of charcoal, indeed, had a band of copper, to which was adapted the strip for establishing the communication: this copper collar, tightly pressed on the cylinder of charcoal, is covered with mastic externally, with the view of preventing the corrosion of the metal; but it was not foreseen that the acid, penetrating into the charcoal, would rise, by virtue of capillary attraction, to the top, and attack the copper, converting it into nitrate and sulphate. Now, we know, from Pouillet's investigations, that the conductibility of copper is sixteen million times as great as that of a saturated solution of sulphate of copper, which explains the diminution in the intensity of the current. It may even happen that the communica-

* *Comptes Rendus*, No. 16, Oct. 15th, 1849.

tion may be entirely interrupted, and it is easily understood that, in a battery, a single element being in this situation would disturb the experiment.

One consequence of the corrosion of the copper is, that the strip which serves to establish the communication is detached, and falls, and the battery is thus rendered unserviceable.

Being informed of these facts, M. Deleuil immediately changed the fittings of the charcoal, and, owing to his skill, all these inconveniences have disappeared.

The new charcoal pierced in its axis, during its fabrication, receives a piece of very strong copper, entering into it to the depth of 3 or 4 centimetres, and fixed solidly to its lower part by a vise which is perpendicular to it. This piece, previously well covered with mastic, is not in contact with the charcoal; it is isolated, and safe from corrosion; it has only a mechanical purpose, and may be of glass or wood; it is square, and bears at its upper end a vice, which, by its pressure, puts the charcoal in communication with a plate of copper soldered to the zinc; the extremity of the plate is of platinum, in order that the nitric acid may not attack it.

ON A KIND OF ANTHRASCHISTOID LIGNITE FOUND IN BORING A WELL NEAR PARIS.*

BY J. L. LASSAIGNE.

On an estate situated on the road to Fontainebleau, and not far from the barrier of that name, a bed of lignite has recently been discovered at a depth of 35 to 40 metres.

This lignite, of a fine black color, occurs in layers which still resemble those of the wood which gave rise to it; it has the appearance of wood charcoal, burns difficultly without smoke or odor, and leaves a grey and slightly yellow ash, very soft to the touch. The numerous fissures of this lignite are partially filled with persulphuret of iron.

This lignite, like all the other kinds, was met with under a very thick bed of plastic clay. The specimen which was sent to us for examination appears to differ from those already found in the Paris basin; in some respects it resembled anthracite; which induced us to designate it anthraschistoid lignite.

The density of this fossil was found to be 1·262 at 64° F. Water exerts no action on it, extracting from it only a small quantity of sulphate of lime. Solutions of potassa or ammonia, put in contact with this lignite pulverised, gradually become colored, and, when cold, is of a brownish yellow, having dissolved a certain quantity of ulmic acid, which is separated by means of acids.

Quantitative analysis indicated the following proportions:—

Water	45·8
Charcoal mixed with a small quantity of ulmic acid	50·2
Ashes formed of carbonate of lime, clay, and oxide of iron	4·0
	100

* *Journal de Chimie Medicale*, Nov., 1849.

EXPERIMENTS ON THE CHEMICAL STATICS OF THE SHEEP.*

BY M. BARRAL.

We had the honor, about a year ago, to present to the Academy a memoir on the chemical statics of the human body. We have since continued this kind of investigation, with the view of increasing, if possible, the present data of the science on the chemical statics of organised beings in general. The experiments of M. Boussingault and MM. Valentin and Brunner having already established, as regards oxen and horses, at least approximately, the relations which exist between the alimentation, the perspiration, and the evacuations, we have operated on sheep, which had not been submitted to any systematic chemical investigation. The general results at which we have arrived are in accordance with those obtained in the case of man and other animals, and, especially as to perspiration, with those of the very conclusive experiments of Regnault and Reiset. However, differences will be met with which merit some attention, especially on the part of agriculturists, for the sheep is one of those domestic animals which extract from a given quantity of food the least amount for assimilation, that is to say, which furnishes, relatively, the greatest mass of excrement. Although the discussion of the different circumstances which we have examined cannot be given in this brief note, and are reserved for special and early publication, we have extracted from our work the explanation of a fact which appears to be of some importance.

Our experiments on sheep have been directed in such a manner as to indicate what effects are produced by a salt diet. For that purpose we took a sheep accustomed to receiving salt, and submitted it to a first experiment of the duration of five times twenty-four hours, during which time all the food

* *Comptes Rendus*; Oct. 15.

and evacuations were estimated and analysed. Twelve grammes of salt per day were given to it. After these five days the sheep ceased to receive the salt for ten days. At the end of this time I again estimated the food and collected the evacuations during four times twenty-four hours. Immediately after, the sheep again received salt, and after seven days, at the end of which it had resumed its customary saline diet, I made a third experiment of four days, giving 8 grammes of chloride of sodium per day. The analysis of the urine of the three experiments made known the remarkable fact that chloride of sodium largely increased the proportion of nitrogen evacuated in this way.

Thus, the dry organic matter (ashes deducted) of the urine contained—

	I.	II.	III.
Nitrogen, per cent.	24·51	9·83	17·47

Thus, also, the average quantities of nitrogen daily passed off in the urine in the three cases were—

Nitrogen passed off in one day—grammes..	I. 5·69	II. 1·68	III. 3·55

The excess of nitrogen obtained in experiments I. and III., in which the sheep received chloride of sodium, furnished almost integrally a corresponding excess of urea. This is evident from the following cyphers :—

Urea in 100 of dry organic matter, &c. ..	I. 40·57	II. 16·60	III. 29·54
Urea passed in one day (average) — grammes	9·42	2·84	6·03

There was likewise an increase in the proportion of uric acid passed under the influence of the salt regimen, and in a general manner the daily evacuation of urine is much increased both by the water which holds in solution, when the experiment is continued long enough, almost all the chloride of sodium swallowed, and by the organic matter which passes out at the same time. This fact of the fixation of a greater proportion of nitrogen in urine, and of a corresponding diminution of the fraction of nitrogen which escapes directly into the atmosphere in the state of gas, is completely in accordance with the variations already observed of the nature of the solid materials of urine when the food is to be changed.

RESEARCHES ON THE PROPORTION OF NITROGEN ABSORBED FROM FOOD IN THE NUTRITION OF BIRDS.*

BY J. L. LASSAIGNE.

A CERTAIN number of experiments performed on some mammiferous animals have already demonstrated that the proportion of nitrogen contained in the natural excretions was inferior to that existing in the food consumed by these same animals in a given time. The results published by M. Boussingault as regards the cow and the horse testify, indeed, that the difference of nitrogen is less for the products of digestion. According to this skilful experimenter, in the interval of twenty-four hours there was, by the assimilation of the aliments, absorption of a nitrogenous matter representing 27 grammes of nitrogen for the cow, and only 24 grammes for the horse.

We desired to repeat an analogous experiment on other animals, and the opportunity afforded to us a year ago by M. Gannal was seized with the greatest readiness. M. Gannal, whose ideas concerning digestion are somewhat opposed to ours, requested us to analyse comparatively the millet with which a goldfinch had been fed for four days, and the excrements passed by it, collected with the greatest care in the same time. According to the data furnished to us by that chemist, the bird had consumed, during the ninety-six hours of observation, 23 grammes, 5 decigrammes of millet. The excrements which it voided, after drying, weighed 7 grammes, 5 decigrammes. The elementary analysis of these two matters, made in the combustion tube, by means of binoxide of copper, gave the following results :—

	Grammes.
Nitrogen in 1 gramme of the millet	0·00708
Nitrogen in 1 gramme of excrements	0·00970

In calculating from these numbers, deduced from direct experiment, the quantity of nitrogen, which existed in the 23 grammes 5 decigrammes of millet consumed, and that which was contained in the 7 grammes 5 decigrammes of excrementitious matter, we obtain :—

	Grammes.
Nitrogen contained in the grain consumed	0·164
Nitrogen „ in the excrements	0·072
Difference	0·092

This last number, which represents the quantity of nitrogen absorbed during four days, divided by 4 gives 0·023 grammes of nitrogen for twenty-four hours.

This proportion of nitrogen absorbed by the bird in one day forms the seventh part of that contained in the millet consumed; it is equivalent, consequently, to 3 grammes 81 decigrammes of the latter, which becomes the weight of the ration digested in 24 hours by the goldfinch.

The bird experimented on having eaten,

* *Journal de Chimie Medicale*, Nov., 1849.

as already stated, 23 grammes 5 decigrammes of millet in four days, it results from the above-mentioned facts that, of the 5·87 grammes eaten in one day, 2·06 grammes must have passed out with the excrementitious matter, mixed with the products of digestion. This result would, therefore, demonstrate that, in the state of captivity in which this bird lived, only about $\frac{2}{5}$ of the food consumed was assimilated. Is it the same with a bird at liberty? This is not probable; the condition being so different there is every reason to believe that there must be a difference in the accomplishment of the phenomena of nutrition.

However, it is evident, from the facts given in this note, that in birds, as in the mammiferæ, there is an assimilation of a certain quantity of nitrogen arising from the food; that this proportion amounted, in the goldfinch, the subject of this experiment, to only 0·023 gr. in 24 hours; considered with relation to the matter digested, this proportion formed $\frac{1}{115}$ of this mass.

In comparing these results with those obtained by M. Boussingault, in the feeding of a cow and of a horse, we are struck with a certain relation between them; indeed, if we compare the quantities of nitrogen assimilated by these animals in 24 hours, we find that the numbers represent these quantities formed for the cow $\frac{1}{4}$ of the proportion of the nitrogen contained in the aliments consumed, and $\frac{1}{3}$ of that contained in the food taken by the horse; with relation to the alimentary mass assimilated, the nitrogen absorbed would be $\frac{1}{115}$ of the food in the cow, and $\frac{1}{77}$ in the horse. The differences observed in this last comparison are due to the nature of the aliments, which present more or less nitrogen in their composition.

ON THE NATURE OF THE LACTIC ACID IN THE STOMACH.*

BY W. HEINTZE.

The author has isolated the lactic acid contained in the gastric juice of a female, and proved that it is the ordinary modification of the acid, and not the paralactic acid occurring in muscular flesh.

A dyspeptic female, who took but little food, occasionally vomited a somewhat turbid liquid, containing only minute traces of the food. It had a strongly acid reaction: it was strained through linen, filtered and evaporated in the water bath to the consistence of syrup. Alcohol separated a tenacious brown substance. The alcohol in the supernatant reddish-brown liquid was distilled off, and the residue evaporated to a syrup; this was shaken for some time with ether, the etherial solution filtered and set aside to evaporate. The residue was an acid syrup, containing some acicular crystals which were not further examined.

The syrup not dissolved by the ether was mixed with a few drops of muriatic acid, and again agitated with ether; when evaporated, more of the acid syrup remained. This was now boiled with oxide of zinc and water, and lactate of zinc obtained by crystallisation.

At 212° the air-dried salt lost 18·14 per cent. of water. This agrees with the amount of water in ordinary lactic acid, which contains 3 atoms, or 18·18 per cent., and readily parts with it at 212°; whilst paralactic acid contains only 2 atoms, or 12·33 per cent., and loses it at 212° F. with far more difficulty.

The analysis of the dried zinc salt, moreover, yielded:—

Carbon.....	6	29·74	29·62
Hydrogen.....	5	4·29	4·12
Oxygen	5	32·51	32.91
Oxide of zinc ..	1	33·46	33·35
		100·00	100·00

It is evident that a portion of lactic acid must be contained in the free state in the gastric juice, as it was immediately taken up by the ether. Some may have been present combined with bases, and have been set free by the addition of muriatic acid; yet, as lactic acid expels muriatic acid on evaporation with chlorides, even a portion of the last quantity must have been in the free state in the stomach. The author recommends preparing the salt of lime instead of that of zinc, as the lime salt of paralactic acid is less soluble than that of the ordinary lactic acid; therefore, should the former exist, it would not be so easily overlooked.

* *Jenaische Ann. Physiol. und Med.*, vol. p. 222.

ON THE METALS OF PLATINUM.*

BY M. C. CLAUS.

EXAMINING the residuum of the treatment of platinum by its solvent gave the author an opportunity of observing several re-actions occurring between the metals of platinum and their combinations hitherto unremarked, but appearing to him worthy of attention. The following is a sketch of these re-actions:—

I. *Chloride of Iridium and Nitrate of Silver.*—It is well known that the chlorine

* *L'Institut*, Aug. 1, 1849.

of the solutions of the various metals of platinum is not precipitated by the nitrate as pure chloride of silver. Chloride of iridium gives a compound which M. Claus terms an argento-sesquichloride of iridium, insoluble in water or in acids, and difficultly soluble in ammonia, from which it can always be obtained in the form of rhomboïds, brilliant as diamonds. The author analysed this salt, and found it to correspond to the formula $3\ Ag\ Cl, + Ir^2\ Cl^3$.

II. *Action of Sulphuric Acid and Sulphite of Potassa on the Chloride and Double Compounds of some of the Platinum Metals.*—The higher chlorides of the platinum metals are reduced to a lower degree by sulphurous acid, chloride of platinum into protochloride, and chloride of iridium into sesquichloride, &c. With the double salts of these chlorides, sulphite of potassa gives a series of compounds of a composition containing sulphurous acid, communicating to them very peculiar qualities.

Compounds of Iridium.—When to prepare potassio-sesquichloride of iridium, eight parts of water are poured upon potassio-chloride of iridium in fine powder, and sulphurous acid is passed through the liquor until an olive-colored solution is formed, the chloride becomes a sesquichloride, accompanied by the formation of sulphurous and hydrochloric acids. This salt, represented by $3\ K\ Cl + Ir^2\ Cl^3 + 6$ Aq. effloresces readily in dry warm air; it is opaque, and its crystals become covered with a bright green powder. Insoluble in alcohol, it is soluble in water, forming an olive-green solution, but in transmitted light, slightly purple. It has the bitter taste of chloride of iridium; but is more permanent and the solution may be evaporated nearly to dryness without decomposition. The alkalies decompose it with difficulty. Aqua-regia converts it readily into chloride, and nitrate of silver instantly precipitates the double salt $3\ Ag.\ Cl + Ir^2\ Cl^3$, without any blue re-action.

The solution of potassio-chloride of iridium, reduced by sulphurous acid, and from which the greater part of the sesquichloride may be precipitated by carbonate of potassa, passes, if heated for some time, from its original olive-green color to red, and, finally, to a bright yellow.

It forms also several compounds of peculiar composition, which contains sulphurous acid, and which, being mixed, may be separated, some in a crystalline form, and others in that of powder by evaporations which are of difficult execution. M. Claus succeeded in isolating three:—A rose-colored crystalline salt, an amber substance of the consistence of Venice turpentine, and a white pulverulent compound. All these compounds contain potassa, sulphuric acid, chlorine and protoxide of iridium in varying proportions. They are nearly insipid, and but slightly soluble in water, disengage sulphurous acid when heated, and are with difficulty decomposed by calcination.

Hydrochloric dissolves them readily, disengaging a part of the sulphurous acid, and converting them into other salts containing an equivalent of chlorine. The aqueous solution with chloride of barium gives a white flocculent precipitate, and the alkalies decompose them with difficulty. Aqua-regia oxidises them slowly, and before conversion into chloride of iridium they assume a deep cherry-red color.

Analysis gives the following formula for the rose-colored salt:—

$$(2\ KO, SO^2 + 2\ KCl) + (2\ Ir\ O \begin{cases} 2\ SO^2 \\ Cl \end{cases}$$

M. Claus has analysed the amber-colored substance resembling turpentine, and gives as its rational formula:—

$$4\ KO, SO^2 + 2\ Ir\ O + \begin{cases} 2\ SO^2 \\ Cl. \end{cases}$$

The white salt of iridium, obtained only in small quantity is thus represented:—
$3\ KO, SO^2 + Ir\ O^2, SO^2 + 5$ Aq.

By treating this salt with hydrochloric acid a yellow solution is obtained, which, evaporated, yields yellow prisms, considered by M. Claus to be a double salt, or sulphite of protoxide of iridium and chloride of potassium, $3\ K\ Cl + Ir\ O^2, SO^2$.

Compounds of Osmium.—The potassio-chloride of osmium undergoes no modification by sulphurous acid at ordinary temperatures, but, when heated, sulphite of potassa causes partial decomposition, producing a pulverulent precipitate, which is a double sulphite of potassa and osmium, represented by the formula $3\ KO, SO^2 + Os\ O^2, SO^2 + 5$Aq. Treating this salt with hydrochloric acid, produces the double salt, $3\ K\ Cl + Os\ O^2, SO^2$, or chloride of potassium and sulphite of osmium.

Compounds of Platinum.—The author briefly describes the preparation of potassio-chloride of platinum, which, when heated with sulphite of potassa, forms a white substance, which, from analysis, M. Claus considers a double sulphite of potassa and platina, $3\ KO, SO^2 + Pt\ O^2, SO^2 + 2\frac{1}{2}$ Aq.; it resembles the salt of osmium, but is more insoluble, almost insipid, heavier, and contains only half the quantity of water. With hydrochloric acid it acts differently from the preceding salts; for it loses all its sulphurous acid, and is converted into potassio-chloride of platinum.

Compounds of Ruthenium.—Sulphurous

acid acts but little upon the potassio-sesquichloride of ruthenium at low temperatures; but a solution of the salt treated with sulphite of potassa becomes of a deeper red color, and a pulverulent yellow precipitate separates from the liquor. Repeated solution and crystallisation obtains this substance of a white color, and the author is of opinion that its composition is the same as the other salts obtained from the other platinum metals; but the small quantity of ruthenium which he had at his disposal prevented him from ascertaining.

CHEMICAL EXAMINATION OF COPROLITIC REMAINS FROM DIFFERENT PARTS OF ENGLAND.*

BY THORNTON J. HERAPATH, ESQ.

To the Editor of the Chemical Gazette.

MY DEAR SIR—In a recent number of the *Chemical Gazette* there was inserted a short paper of mine on the analysis of a peculiar phosphatic earth from Sussex, which was stated to have been found in large quantity in many districts of that and some other counties, particularly in the lower beds of the cretaceous system, and had been lately introduced to a considerable extent as a substitute for bone earth in the preparation of superphosphate of lime for agricultural purposes. Since the publication of that notice I have had occasion to examine professionally several other coprolitic remains from different parts of England. These bodies, I need hardly remind you, are supposed by geologists to be the fossilised excrements of the ichthyo and plesiosauri, and are now, in consequence of the extraordinary fertilising powers they have been discovered to possess, most extensively used in commerce for similar purposes to the above. As the results of my analyses may contribute in some measure towards rendering our knowledge of the composition of these coprolites more complete, and their value as a manure more generally known, I have no doubt but that you will do me the favor to make my scientific brethren acquainted with them, through the medium of your pages, in the shape of an appendix to my former paper.†

I. The following are the analyses of two coprolites from the coast of Suffolk. These were of an oval form, weighing between 600 and 700 grains each, and their external surfaces were much water-worn and highly polished. Their color was brownish ferruginous; they were easily fractured, and, when triturated in an agate mortar, yielded a yellowish-red powder. The specific gravity, at 60° F., was 2,815 or 2,850.

Composition per cent.:—

	I.		II.	
Water with a little organic matter	4·000		3·560	
Salts soluble in water (chloride of sodium and sulphate of soda)	traces		traces	
Carbonate of lime	10·280		8 959	
Carbonate of magnesia	a trace		a trace	
Sulphate of lime	distinct traces		0·611	
Phosphate of lime (3 CaO, PO^5)	70·920 = PO^5	32·765	69·099 = PO^5	31·924
Phosphate of magnesia	traces only		traces	
Perphosphate of iron (2 Fe^2 O^3, 3 PO^5)	6·850 = PO^5	3·244	8,616 = PO^5	4·081
Phosphate of alumina (2 Al^2 O^3, 3 PO^5	1·550 = PO^5	0·870	2 026 = PO^5	1·156
Oxide of manganese	traces		0·016	
Fluoride of calcium	0·608		0·804	
Silicic acid, colored red by a little decomposed silicate of iron	5·792		6·309	
	100·000 = PO^5	36·889	100·000 = PO^5	37·163

Fifty grains of the first specimen, in fine powder, when burnt with potash lime, furnished 0·20 grains of platino-chloride of ammonium, which is equivalent to 0·0254 per cent. of nitrogen.

It is said that the coprolites which Mr. Lawes employs in the manufacture of his well-known "Coprolite Manure," are obtained from the Suffolk coast, and are similar in character to the above.‡

II. This one was brought from the same

* *Chemical Gazette*, No. 170, p. 449.

† No. 152, vol. vii., p. 70.

‡ In an excellent paper, "On the Phosphoric Strata of the Chalk Formations," published in the first number of the *Journal of the Royal Agricultural Society of England* for last year, Mr. Way observes that he has found the coprolites from this district to contain from 52 to 54 per cent. of bone-earth phosphate, and that Dr. Gilbert had

part of the coast as the preceding, but differed from them in its irregularity of form, and in exhibiting imperfect evidences of a bony structure. The specific gravity it was found impossible to determine, on account of the numerous air cavities it contained.

Analysis showed it to possess the subjacent per centage composition:—

Water driven off at from 300° to 350° F.	2·600	
Water and organic matters expelled at a red heat	9·000	
Chloride of sodium, &c.	evident traces	
Carbonate of lime	39·500	
Carbonate of magnesia	0.520	
Sulphate of lime	distinct traces	
Phosphate of lime (tribasic)	15·860 = PO^5	5·287
Phosphate of magnesia	traces	
Perphosphate of iron	9·200 = PO^5	4·358
Phosphate of alumina	4·708 = PO^5	2·764
Peroxide of iron	none	
Alumina	6·212	
Fluoride of calcium	1·698	
Silicic acid	10·601	
	99·899 = PO^5	12·409

The proportion of nitrogen in this specimen was not estimated.

III. This coprolite was discovered in the lias strata of Lyme Regis, and was kindly presented to me by my esteemed friend, Edward Barker, Esq., of Budleigh, Salterton.

It was rather large, being above nine ounces in weight, was of a greyish color, and, when broken, exhibited some traces of a crystalline structure. It was considerably softer than either of the preceding, and furnished a greyish-white powder. Many scales of different extinct fishes, and other organic remains, were to be perceived on the external surface; the greater proportion of them appeared to belong to a species of fish which is known to ichthyologists by the name of *Pholodiphorous limbatus*. Its specific gravity was about 2·644 or 2·700, and the composition per cent. was as follows:—

	I.	II.	Mean.	
Water driven off at from 300° to 350° F	2·560	2·668	2·6140	
Water and organic matters expelled at a red heat	3·680	3·456	3·5680	
Chloride of sodium, with some sulphate of soda	traces	traces	traces	
Carbonate of lime	23·640	23·708	23·6740	
Carbonate of magnesia	none	none	none	
Sulphate of lime	1·740	1·801	1·7705	
Phosphate of lime (tribasic)	60·726	60·813	60·7695 = PO^5	28·047
Phosphate of magnesia	a little	a little	a little	
Perphosphate of iron	3·980	4·135	4·0575 = PO^5	1·922
Phosphate of alumina	a little	a little	a little	
Peroxide of iron	2·094	1·894	1·9940	
Alumina	none	none	none	
Silicic acid, with fluoride of calcium and loss	1·580	1·525	1·5525	
	100·000	100·000	100·000 = PO^5	29·969*

The proportion of nitrogen in this specimen was rather large, being 0·0826 per cent.

Yours very truly,

THORNTON J. HERAPATH.

Mansion House, Old Park, Bristol,
3 Nov., 1849.

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informed him that, in several analyses which he had made of samples taken from several tons of the ground coprolites, he had found the proportion of phosphate of lime to vary between 55 and 57 per cent. Mr. Nesbit (*Quart. Journ. of Chem. Soc.*, Part III., p. 235) found from 22·30 to 28·74 per cent. of phosphoric acid, which is equivalent to from 48·31 to 59·07 of tribasic phosphate, in those from the tertiary deposits of this county.

* In the first of these analyses, the phosphoric acid was estimated by M. Schulze's method, as perphosphate of iron; in the second as phosphate of lead.

ON GLUIRINE IN MINERAL WATERS.*

BY M. BONJEAN.

Bordeu, who appears to have been the first to remark it, compared the gelatinoid substance of mineral waters to white of egg, and regarded it sometimes as a fatty matter, and sometimes as a bituminous matter. Bayeu ascertained that it gave empyreumatic products on being distilled. Vanquelin declared that it was an animal substance analogous to albumen and gelatine.

Some authors have varied the name of this substance according to the name of the water in which they found it: thus it has been called baregine, plombierine, &c. But Angluda, having discovered its identity, and, we may add, its existence in hot springs, gave it the name of gluirine, with the view of calling to mind its most striking characteristic—its gluiry appearance.

In studying this body, M. Bonjean had an opportunity of observing a variety, which he designates under the name of gluiridine, and of discovering a new nitrogenous product of violet color, which, for these considerations, he calls zoïodine.†

According to M. Duby, a learned Genoese botanist, who, at the instance of M. Bonjean, made a microscopical examination of gluirine, this substance is not a chemical product, but an organised being, an extremely minute plant, with an extraordinarily fine undular tissue, folding on itself, and having the appearance of an animal detritus. It would be produced by the direct action of the air on the mineral water.

From M. Bonjean's experiments it results:—

1st. That gluirine contains very little nitrogen.

2nd. That it contains no iodine in combination.

3rd. That it dissolves in small quantity in water, alcohol, essence of turpentine, and in rather larger quantity in the concentrated acids, from which the acids precipitate it in blueish flocks; in all cases, heat increases the solvent power of the liquid.

4th. It is entirely insoluble in ether.

5th. It rapidly acquires a grey color as soon as it taken out of the water; but it is sufficient to put it in contact with nitric or hydrochloric acid, or with bromine or liquid chlorine, to restore its natural whiteness; sulphuric acid, far from decoloring it, makes it assume the color of wine leys.

6th. The concentrated alkalies turn it green with heat.

7th. In water it has little odor, but out of it it acquires a very repulsive odor.

8th. It becomes inodorous by drying in an oven; after which, it assumes a horny appearance, and is reduced one-tenth in weight.

9th. Hydrochloric acid, in decoloring gluirine, acquires a yellow color, owing to the formation of a persalt of iron, which shows that gluirine contains iron in combination. Iodine gives it a brick-red color.

Gluiridine differs from gluirine, in being naturally grey instead of white; in remaining inodorous even in the air; in drying in the air; in not being decolored by acids or chlorine; in not being turned green by the alkalies; in not becoming horny, but friable by desiccation; and in containing traces of iodine.

This matter is produced at the period of the mixing of other waters with sulphurous waters.

When gluirine is taken out of the water in which it is formed, and drained on a filter, the first water which passes off is rather white, and deposits, after three or four days, bracteæ of a fine iridescent violet color. This new body is zoïodine, an inodorous, insipid subtance, unalterable in the air, insoluble in water, and which the acids and alkalies turn brown; on calcination, it gives the odor of burning horn.

It may be well to mention that, in the analyses of various earths (marls, dolomites, carbonate of lime, &c.), an organic product analogous to gluirine has been detected, whence it results that this substance exists also in the mineral kingdom.

ON THE PRESENCE OF ANTIMONIATE OF COPPER IN THE CRUDE COPPER OF THE HARTZ, AND ITS SEPARATION THEREFROM.

BY ISAIAH DECK.

The samples of crude copper from the Hartz district present little variety, and may be considered as a fair average of the copper of commerce; yet instances are not uncommon in which some striking peculiarity manifests itself after the metal has passed through most of the processes to fit it for the market. Such a sample was sent to me for assay, from the Smelting Works of Pokenhutte, in the vicinity of Goslar, which, when cast into the usual ingots, presented on the under surface a columnar hexagonal crys-

* *Journal de Chimie Medicale*, October, 1849.

† We think that this product had been already observed by M. Regnier in the waters of Vichy.

alline structure, and, on account of its splitting and cracking under the rollers, was quite unfitted for the purposes of commerce. Suspecting the presence of sulphuret of antimony, which, even in a minute proportion, is detrimental to the malleability of copper, I endeavored to detect and remove it by the usual process of sublimation and roasting, but did not succeed in obtaining any satisfactory results; and I, therefore, concluded that, if the suspected metal were present, it was in combination with another as an antimoniate, and subsequent analysis proved the correctness of this idea.

A portion was digested, for some days, at a gentle heat, in dilute nitric acid. This dissolved the pure copper, and disintegrated a brilliant crystalline powder, closely resembling mosaic gold, and, under the microscope, exhibited tubular hexagonal crystals, which, with the usual blowpipe re-agents, showed the presence of a large quantity of antimony and copper.

Being insoluble in strong and dilute nitric acid, it was fused with sulphur and carbonate of soda, lixiviated, and the resulting sesquisulphuret converted into oxysulphuret by sulphuric acid, the residue on the filter was shown by the blowpipe and ammonia to be almost all copper.

The filtrate, after subsidence of the oxysulphuret, was treated with caustic potassa, and gave a greenish-brown precipitate, partly soluble in carbonate of ammonia; carbonate of soda gave a greenish blue; ferroprussiate potash a rich blue, indicating the presence of nickel and iron; hydrosulphate of ammonia gave evidences as a dense black precipitate, which, being freed from the two former, and examined by the blowpipe, showed the nickel to exist also as an antimoniate, insoluble in nitric acid. The antimoniate of copper, to which the formula Cu Sl may be assigned, was found, on a subsequent quantitative analysis, to exist as 3·38 per cent., showing how small a quantity was sufficient to deteriorate the entire mass of crude metal.

Dublin, Nov. 15, 1849.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

NATURAL SOURCES OF SULPHURIC ACID.—NEW MODE OF MANUFACTURING SULPHURIC ACID.*

BY M. C. BLONDEAU.

THERE exist in nature abundant sources of sulphuric acid. Boussingault noticed in America several acid waters, and in particular the Rio Vinagre, or Pasiambo, which contains, in 1,000 parts, about 2 parts of sulphuric acid. According to Boussingault's gauging, the Pasiambo yielded, in 24 hours, 38,610 kilogrammes of sulphuric acid, and this quantity is greatly exceeded by the discovery made by Degenhart in the Paramo de Ruiz, the water there containing, according to Sewy's analyses, three times as much sulphuric acid as the Pasiambo. Whence arise these enormous quantities of sulphuric acid? What are the processes which Nature employs for their formation? A phenomenon of the highest interest, which has attracted my attention in the department of Aveyron, has enabled me to account for the natural formation of this acid, and, by availing myself of the conditions presented in the localities which I have studied, I have been able to manufacture sulphuric acid with ease, without having recourse to the complicated processes generally adopted.

In many points of the coal earth of the department of Aveyron, and especially in the environs of Cransac (arrondissement of Ville Franche), is observed the phenomenon I have alluded to—the spontaneous combustion of the soil, which manifests itself by a disengagement of gas and vapors resembling, at a distance, a little volcano. In approaching the place where this combustion is carried on, it is perceived that the ground is undermined, and now and then large crevices are discovered from which steam and acid fumes are abundantly disengaged. On the edge of one of these fissures the heat is insupportable, and we are not surprised that the effects of this heat, united with the action of these acid gases, have so completely modified the places in which these chemical actions are exerted. In some parts of the burning mountain are observed enormous rocks, formed of conglomerations, which, having undergone the action of fire, have completely changed in aspect, and are connected by a cement which owes to the action of heat its brick-red color. The substance

* *Comptes Rendus*, No. 16, 15th Oct., 1849.

of the burning mountain was formed of free-stone, schist, and clay; these substances have assumed the appearance of chalcedony, jasper, enamels, glasses, bricks, and, sometimes, even the cavernous appearance of volcanic stones. The aggregations which these substances have formed with the clay have acquired, sometimes, the hardness of the most compact stones. The earth, undermined by the chemical actions carried on within it, ultimately falls in, giving rise to cavities, which, from their conical form, resemble the craters of volcanos: from these vent-holes are disengaged columns of vapors which, sometimes, rise to a great height in the air, and, at other times, are driven back by the wind into the valleys. In these places, the investigator finds a number of saline concretions, efflorescences, crystals of sulphur, and hydrochlorate of ammonia—products in considerable demand, and which, dissolved in the rain, constitute the mineral waters, which, in the locality I have mentioned, are very frequent. The causes of the phenomena are evident to every one who has proved the presence of sulphuret of iron, which is found in such abundance in the various beds of coal earth which constitutes this locality. This sulphuret, in contact with water and atmospheric air, burns, and gives rise to sulphurous acid gas, and this is converted into sulphuric acid under the influence of air and bases, such as alumina and oxide of iron. The sulphates of iron and alumina which are formed in this case are decomposed by the action of heat, and sulphuric acid is liberated.

The temperature which results from these different re-actions is sometimes sufficiently high to cause the layers of coal on the surface of the earth to inflame, and the products of the combustion of the coal unite with the vapors of the water and sulphuric acid, and thus augment the grandeur of the phenomenon. The sulphuric acid, formed in these conditions, exerts a very powerful action on both the mineral and organic substances which it meets with in its passage; it is remarked, indeed, that the trunks of trees in the vicinity of the burning mountain have the black color of substances which have been steeped in sulphuric acid. As for the mineral substances, they are also powerfully attacked by this energetic acid, which exerts its action at once on the silica, alumina, lime, oxide of iron, earths, and alkalies, which contribute to the composition of rocks, and in consequence of this action sulphates are produced, amongst which is found the double sulphate of potassa and alumina (alum) in sufficiently great quantities to be turned to account in commerce.

We have made analyses of these efflorescences which we collected on the burning mountain of Cransac. These efflorescences were white, very acid, reddening litmus paper, and attracting moisture from the air. After having dried them in the vacuum of the pneumatic machine, we took 50 grammes, which we dissolved in one quart of distilled water, on which we operated as on ordinary mineral water. The following is the result of our analysis:—

Sulphate of alumina and potassa	24·25
Sulphate of alumina.....	53·31
Sulphate of magnesia	3·47
Sulphate of manganese.....	1·35
Sulphate of iron	10·29
Free sulphuric acid	7·33
	100·00

In examining the natural process which gives rise to the large quantities of sulphuric acid found not only in combination with bases but free, we have been led to ascertain whether, by imitating these conditions, sulphuric acid could not be immediately produced by means of sulphurous acid gas.

For this purpose we placed some argillaceous sand in a porcelain tube, and we put one extremity of this tube in communication with two flasks, over one of which sulphurous gas was disengaged, and from the other steam; and, at the same time, we passed air into the apparatus by means of a gasometer. To the other extremity of the tube was attached a bent tube, dipping into water in a double tubulated flask, one neck of which was fitted with a disengagement tube. This apparatus being thus arranged, the porcelain tube was surrounded with burning charcoal, so as to raise its temperature to dull redness, and then the air, steam, and sulphurous acid were driven through it. The body which was disengaged at the extremity of the tube was sulphuric acid; by taking care to keep up an excess of air very little sulphurous acid escaped, very nearly all being converted into sulphuric acid.

To pass from this laboratory experiment to a manufacturing operation, it would be necessary to produce the sulphurous acid gas by the combustion of sulphur or a sulphuret, and to make the product of this combustion pass into a cast-iron cylinder, strongly heated, and containing argillaceous sand, at the same time passing through it an excess of steam. Sulphuric acid would be collected at the other end of the cylinder. This arrangement would, doubtless, be preferable to that now employed, and by using an apparatus of this construction, sulphuric acid might be made at a much lower price than at present.

ANALYSIS OF THREE SAMPLES OF BLACK ASH, WITH REMARKS ON THE THEORY AND PRACTICE OF THE FABRICATION OF SODA.*

BY N. SAMUELSON,
Of the Liverpool College of Chemistry.

(*Read before the Liverpool Chemists' Association, November 23rd*, 1849).

PROFESSOR Muspratt, some time ago, directed the attention of his brother Frederick and Mr. Joseph Danson, of this College, to the preparation and analysis of various kinds of black ash and soda ash. These gentlemen have published their results in the "Chemical Society's Transactions" (April 1st, 1849, page 2; and October 1st, 1849, page 216). At the request of my preceptor, I have continued the subject, with the view of showing, *principally*, that the more coal that is used up to a certain point, the better is the decomposition and produce.

The degree of general interest attached to a subject is, or ought to be, always proportionate to its practical usefulness; consequently, an inquiry into the manufacture of soda—an article which enters largely into the composition of glass and soap, and which has increased, directly and indirectly, the revenue of our country by nine millions annually—cannot fail to interest this meeting. At present, the method in practice of making soda from common salt was discovered by Leblanc, but the successful application of this process is due to the industry of this country. Soda is now manufactured on the large scale to about 100,000 tons per annum, and Spanish barilla and kelp, which were formerly used, are lost in oblivion. As in the introduction of every new process, prejudice will have its sway; it was most difficult at the commencement of this important manufacture to induce soap-makers, glass manufacturers, and bleachers to avail themselves of so important a discovery. So great was the prejudice of the bleachers in Manchester that they preferred potashes, at 30*l.* per ton, to soda, which was only half the price.

The manufacturer, however, employed agents to prove to the bleachers that the same amount of work would be accomplished by soda, and at half the cost. What was the consequence? The trade increased so rapidly, that crude soda was sent out hot from the furnaces in iron carts. Although the soda trade has now been 50 years established, the same process is employed for its manufacture. Improvements have certainly been made in this process; that is, better decompositions have been effected, and I feel convinced that the more it is studied the more lucrative will the manufacture become.

The soap trade employs the most alkali; now to the public, by reducing the price of soap, and increasing the consumption, as in a country where a healthy competition exists, and where trade is unfettered by monopoly, the consumers of an article are certain, ultimately, to benefit by every improvement which reduces its cost. Before stating the results of my analysis, I will describe, as briefly as possible, the process of the manufacture of soda, which may not be uninteresting to young beginners, and persons engaged in the same research.

The preliminary step consists in the formation of sulphate of soda, by the action of sulphuric acid upon common salt. This operation is generally conducted in a large iron pot, with a fire playing under it. Dense fumes of hydrochloric acid are disengaged, which are condensed by means of a long horizontal condenser, filled with fire-brick. The following equation represents the decomposition:—

$$Na\,Cl + H\,SO^4 = Na\,SO^4 + H\,Cl.$$

We next come to the manufacture of black ash, or crude soda. When sulphate of soda is heated to redness with coal and carbonate of lime, in a short time the surface softens, and forms itself into round balls. The mass is continually kept stirred, and bubbles of carbonic oxide are set free, which exude and burn with a blue flame. At last the whole mass melts, and gradually the evolution of gas ceases, the liquid becoming perfectly tranquil. The decomposition is now completed; the black ash, when cold, is lixiviated; the solution is then evaporated to dryness to form the soda of commerce.

The following equations represent the decompositions which take place in the black ash furnace. From the different mixtures, I give only one as an example, as it will be sufficient for my purpose.

$$5\,(Na\,So^4) + 8\,(CaO\,CO^2) + 38\,C = 5\,(NaS) + 8\,(CaO\,CO^2) + 18\,C + 20\,CO = 5\,(NaS) + 8\,CaO + 10\,C + 36\,CO = 5\,NaO + 5\,CaS, 3\,CaO + 10\,C + 36\,CO.$$

Exposure to the flame,

$$5\,NaO + 5\,CaS, 3\,CaO + 10\,C + 36\,CO + 20O = 5\,(NaO\,Co^2) + 5\,CaS, 3\,CaO + 5\,CO^2 + 36\,CO.$$

I have calculated the quantities of lime and sulphur that the above equations should yield, and the following are the results:— Centesimally represented.

Lime	34 to 35
Sulphur	12 to 13

which agree remarkably well with those obtained by analyses.

Some manufacturers believe that too much coal cannot be employed, but this is a decided mistake. A great excess of coal

* Communicated by the Author.

decomposes the Co^2 of the NaO CO^2, giving carbonic oxide $Co^2 + C = 2\ CO$.

Therefore, with a large amount of coal, the soda is very caustic. The black ash is lixiviated in vats, to dissolve out the soda, &c. During this process CaO So^3, CaO S^2 O^2, and Ca S^2 are formed, which may be accounted for in the following manner:—

3 Ca S, CaO + 8 O + 2 H O = CaO So^3 + CaO S^2 O^2 + 2 (CaO H O)

3 Ca S, Ca O + 0 + 2 H O = Ca S^2 + Ca S + 2 (CaO HO)

Mr. Richard Muspratt, who superintends the Liverpool Alkali Works, has kindly provided me with samples of black ash, which were made from the following mixtures:—

The mixture of the first sample was as follows:—

	lbs.		Per Cent. Practice.	Per Cent. Theory.
NaO So^3	168	.....	37 = 8 eq. NaO So^3	34
CaO Co^2	182	.....	39 = 8 eq. CaO Co^2	39
C	112	.....	24 = 38 eq. C	27
	462		100	100

Analysis of First Sample.

No. 1.	Per Cent.		Calculated in 100 parts without charcoal and sand.
Carbonate of soda	11·751	.....	13·038
Carbonate of lime	13·778	.....	15.281
Sulphate of soda	0·772	.....	0·856
Chloride of sodium.....	0·780	.....	0·865
3 Ca S, CaO	33·226	.....	36·852
Sulphide of sodium	1·810	.....	2·007
Silicate of magnesia	1·849	.....	2·050
Iron, alumina, phosphates of lime and magnesia	2·189	.....	2·427
Loss, or caustic soda.....	24·004	.....	26·624
Charcoal and sand.....	9·841	.....	—
	100·000		100·000

The following is the mixture of the second sample:—

	lbs.		Per Cent. Practice.	Per Cent. Theory.
NaO So^3	168	.....	37 = 5 eq. Na O SO^3	37·5
CaO Co^2	182	.....	42 = 8 eq. CaO Co^2	42·0
C	98	.....	21 = 32 eq. C	20·5
	448		100	100·0

Analysis of Second Sample.

No. 2.	Per Cent.		Calculated in 100 parts without charcoal and sand.
Carbonate of soda	25·530	.....	27·702
Carbonate of lime	12·290	.....	13·343
Sulphate of soda.....	0·899	.....	0·976
Chloride of sodium	1·047	.....	1·136
3 Ca S, CaO	34·888	.....	37·878
Sulphide of sodium	0·887	.....	0·962
Silicate of magnesia	4·340	.....	4·712
Iron, phosphates, and alumina	3·553	.....	3·857
Loss, or caustic soda.....	8·670	.....	9·484
Charcoal and sand.....	7·896	.....	—
	100·000		100·000

The following is the mixture of the third sample:—

	lbs.		Per Cent. Practice.	Per Cent. Theory.
Na O So^3	168	.....	38·3 = 5 eq. Na O So^3	38·0
CaO Co^2.....	182	.....	41·2 = 8 eq. CaO Co^2.....	42·7
C.....	91	.....	20·5 = 30 eq. C.....	19·3
	441		100·0	100·0

No. 3.	*Analysis of Third Sample.* Per Cent.	Calculated in 100 parts without charcoal and sand.
Carbonate of soda.....	13·448	14·386
Carbonate of lime	16·045	17·165
Sulphate of soda	1·330	1·422
Chloride of sodium	0·765	0·818
3 Ca S, Ca O	34·859	37·292
Sulphide of sodium	0·337	0·364
Silicate of magnesia	2·304	2·464
Iron, phosphates, and alumina	3·543	3·790
Caustic soda	20·844	22·299
Charcoal and sand.....	6·525	—
	100·000	100·000

In conclusion, I will state that in all technological processes, correct data can only be eliminated by analysis; that is by determining exactly the composition of the product as it comes from the furnaces. A bad black ash will yield a bad soda ash; therefore the great aim of the manufacturer is to effect a good decomposition in the black ash furnace. It is only by the light of science that the manufacturer now-a-days can supersede his neighbour, and more especially in a fabrication which has almost reached its culminating point.

INFLUENCE OF BORACIC ACID IN VITREFACTION.*

EXTRACT FROM A LETTER FROM M. MAES, MANUFACTURER OF CRYSTAL, TO M. DUMAS.

You know that, in conjunction with M. Clemandet, director of my Crystalleric, I have long studied the influence of boracic acid on vitrefaction. The principal results hitherto obtained are:—1. borasilicate of potassa and lime; 2. borasilicate of potassa and zinc; 3. borasilicate of potassa and baryta; 4. borasilicate of soda and zinc.

Borasilicate of potassa and lime was formed with the object of re-producing, in close vessels, in coal furnaces, the finest qualities of Bohemia.

In the account of the "Austrian Exposition of 1845," published by M. Peligot, we find that, in Bohemia, to manufacture the purest and most durable glass, to 100 parts of silica, 12 parts of quick lime, and only 28 parts of carbonate of potassa are employed. It must, therefore, be concluded that the glass is superior in quality as it contains less potassa and more lime.

The above proportions give a glass infusible at the temperature of our furnaces. The addition of a few hundredths of boracic acid suffice to cause its fusion, and the resulting product has all the limpidity, lustre, and hardness to be desired.

This first study very naturally led us to turn to account the solvent property of boracic acid for introducing into glass bases not hitherto used: hence the borasilicates of potassa and zinc and potassa and baryta. The borasilicate of potassa and zinc appears to combine all the qualities of a pure and durable glass. As regards the borasilicate of potassa and baryta, it was made by means of a native carbonate of baryta contaminated with sulphate of baryta and ferruginous gangue. If, therefore, it has more color than the zinc glass, the color is certainly accidental; by making it with pure carbonate, this imperfection would, doubtless, be completely avoided.

The beauty of the borasilicate of potassa and zinc has led us to make a comparative study of borasilicate of soda and zinc; which, although inferior to the former, is, however, incontestably superior to all the soda glasses which have been compared with it.

In conclusion, the borasilicates are principally remarkable for their transparency and hardness. They owe these valuable qualities to a considerable reduction in the proportions of potassa or soda, which are always found in excess in ordinary glasses, and every one knows that too alkaline glasses are cloudy, soft, and hygrometric.

These observations authorise us in thinking that boracic acid must inevitably, and at no very distant period, contribute to the perfection of optical glasses. We intend, with this view, to study the preparation of borasilicates of great density—those into whose composition enter baryta, lead, bismuth, &c.

* *Comptes Rendus*, No. 17, Oct. 22, 1849.

GUANO FRAUDS.*

At a time when sensible men are acting upon the well-known principle that manure is the mother of wealth, and the most effective substitute for protective duties, it becomes more important than ever to point out the enormous frauds to which incautious persons are subject. Under the name of cheap guano, and artificial manures, farmers are continually buying, at exorbitant prices, what is hardly worth the cartage.

We have repeatedly drawn attention to this fact, especially as regards guano. We have shown that, by means of loam, various kinds of refuse, sand, pounded limestone, and other substances, guano is brought into the market so ingeniously falsified as to defy detection, except under the unerring analysis of the chemist. In this way materials possessing no intrinsic value, and, as manures, inert, are bought by unsuspicious agriculturists, at from £5 to £10 a ton, to the great pecuniary loss of the buyers, and to the discredit of one of the most valuable substances in nature. It is no exaggeration to apply that name to genuine Peruvian or Bolivian guano, in the state in which it reaches this country.

We have, at this moment, before us a new sample of the matters with which the guano market is just now supplied. At no great distance from one of our metropolitan railways certain stones are collected, which, being roasted in a kiln, and then crushed, form a most exact representation of the finest pale guano. Neither by touch nor sight can the most practised eye distinguish it, unassisted by the microscope. This stuff is largely consumed in the falsification of guano, at the very moment when these remarks are printed; and there is no doubt that a great deal of the guano that is sold by disreputable dealers consist of it.

What are farmers to do, in order to escape this plunder? The answer is, naturally—consult the chemist—have your samples analysed. But experience shows that men either can not or will not have recourse to this unerring guide; and, therefore, those who are desirous of saving the public from the fraudulent practices that abound in all directions are called upon to propose some other test. Such a test is price; that is to say, when guano is offered below a certain price, the buyer may be certain either that roguery has been practised, or that the sample is so damaged as to be worthless. The quantity of damaged guano now in the market is too inconsiderable to deserve much attention.

* *Gardener's Chronicle*, Nov. 17.

It is to be remembered that the measures taken by the Peruvian Government, render the introduction of genuine guano, through more than one European firm, impossible. That firm is Messrs. Gibbs and Co. All the Peruvian guano on sale has necessarily been bought of them. Now, their price is £9 5s. per ton, in London or Liverpool, and £9 10s. at all other ports. No man, therefore, can sell genuine guano at a lower price, without sustaining loss. Nevertheless, we hear of it in the north of England at £8 10s. and £7 10s., prices at which the retailers must lose from £1 to £2 per ton. Does any one suppose the dealers to be patriots, immolating themselves for the sake of agriculture? Buyers may be sure that they are no such thing; and that their patriotism consists exclusively in filling their pockets at the expense of credulous farmers.

Fraud is at the bottom of all these bargains.

We have now before us analyses of two samples, offered considerably below the cost price of the genuine article. In one of these, at £8 10s., the quantity of ammonia was something more than 10 per cent.; in the other, at £7 10s., it was not quite 8½ per cent. The first contained nearly one-fourth part of sand, and the other just one-third of black earthy matter, resembling ground coprolite, and cost, at the most, £3 per ton.

The valuable analysis of guano by Mr. Way prove that the average per centage of ammonia in genuine Peruvian is 17½ per cent., and that the quantity of sand is not more than 1½ lb. in every hundred pounds, on an average.

In the cheap samples here alluded to, the earthy phosphates, a most important part of the guano, were only 7 lbs. in a hundred in one sample, and about 10 lbs. in the other; but the average amount in genuine Peruvian has been found by Mr. Way to be 24 per cent., or thereabouts.

The following calculation will show the position of the farmer who buys cheap guano, such as the market tempts him with.

	Ammonia.	Phosphates.
Genuine guano at £9 10s. contains	17·41	24·12=41·53
Spurious guano at £8 10s.	10·10	6·80=16·90
Ditto at £7 10s...	8·37	10·21=18·61

As the value of guano depends essentially upon its ammonia and earthy phosphates, it will be evident that if genuine guano, costing £9 10s., contains 41 lbs. of them in every hundred pounds, guano containing 17 per cent. only is worth no more than £3 18s. 6d., so that the dealer who sells such stuff at

8*l.* 10s. pockets £4 11s. 6d. per ton at the expense of the simple purchaser.

There is no evading this result, and therefore it is that farmers are cautioned against having anything to do with low-priced guano until a chemical analysis has revealed the truth about it.

It is true that he may also buy spurious guano at a high price, but against that he may guard himself by a vigilant scrutiny into the character of the person with whom he deals. There are plenty of respectable men all over the kingdom whose reputations place them above suspicion, and to them we earnestly recommend buyers to confine their orders.

APPLICATION OF HOT AIR TO THE SMELTING OF IRON.*

At the smelting furnace of Plous, in Wurtemberg, before employing the hot air, the consumption was 100 kilos (2 cwt.) of ore, 40 cubic feet (48¼) of charcoal, and the produce under the old system was 3,000 kilos (3 tons), while, with the hot air, it is on an average 3,750 kilos (3¾ tons). At Königsbronn, in the same kingdom, to obtain 108 livres (1·17 cwt.) of bar iron with cold air, it required 20 cubic feet (24·2 Eng. c. f.) and with hot air only 17 cubic feet (20½).

The temperature to which the air is raised is, however, much inferior to the lowest standard in this country; for at Plous, according to Berthier, the temperature of the heated air is only 150° or 200° (302° 392° F.), whilst, at the Clyde iron works, the usual test of the standard temperature is the melting point of lead, or 606° F. This is the lowest point to which the heat is allowed to fall, for it may in general be much higher; yet even with this disadvantage in Germany we see that the expenditure of the combustible matter has been reduced one-fourth, with a sensible increase of the product. The effect of the heated air has commonly been attributed to the absence of the cooling power, which was exercised by the cold air on its being introduced in contact with the heated contents of the furnace. Berthier denies that this is the mode in which it operates. He thinks that the phenomena which result from the employment of hot air, proceed from the greater activity of the combustion in the furnace than when the air has not been previously heated; that is to say, that with the same weight of air, there is more oxygen absorbed in the first case than in the second. If this opinion be correct, it follows that less of hot air will be required than of cold air for the combustion of an equal quantity of charcoal in the furnace, and that the air which proceeds from the latter being possessed of little oxygen, cannot support combustion.

Now, the exhaustion of the oxygen in the air is a point of essential importance, when we wish to obtain a strong heat, for the nitrogen of the air only assists in producing a loss of the portion of the heat developed by combustion. Hence, the less air that is consumed, the less does this cause of cooling operate. Besides, the affinity of gas for solid substances is increased by the heating of the gas.

It has been said, that effects similar to those produced by heated air may be obtained by the employment of cold air sufficiently compressed; or what would be extremely powerful, the use of hot air compressed to such a degree as experience might point out.

* *The Patent Journal*, No. 180; November 3rd, 1849.

ON THE MANUFACTURE OF VARNISHED LEATHER IN FRANCE.*

This process consists of two operations; first, the preparation of the skin; and, second, the varnishing of the leather thus dressed.

In the preparation of the leather, linseed-oil, made readily drying, by means of metallic oxides and salts, is employed as the basis; for each 22 gallons of linseed oil, 22 pounds of white lead, and 22 pounds of litharge are employed, and the oil boiled with those ingredients until it has attained the consistence of a syrup. This preparation, mixed either with chalk or ochres, is applied to the leather by means of appropriate tools, and well worked into the pores; three or four layers are applied in succession, taking care to dry each layer thoroughly before the application of the next coating. Four or five coatings of the dried linseed oil, without the admixture of the earthy substances are then given; the addition of very fine ivory black and some oil of turpentine is usually made to the oil. These coatings are put on very thin, and when carefully dried the leather is rubbed over with fine pummice-stone powder, to render the surface perfectly smooth and even, for the reception of the varnish. The varnish is composed as follows:—10 pounds of the oil prepared as above, half a pound of asphalt or Jewish bitumen, five pounds of copal varnish, and ten pounds of turpentine. The oil and asphalt are first

* *The Patent Journal*, November 3rd, 1849.

boiled together, the copal varnish and the turpentine added afterwards, and the mixture well stirred. Instead of asphalt, Prussian blue or ivory black may be employed. This varnish must be kept in a warm place for two or three weeks before it is fit for use.

The greatest possible care must be taken both before and during the application of the varnish, to prevent the adherence of any dust to the leather. The leather, when varnished, must be put into drying stoves, heated to about 90° or more, according to the nature of the leather and the varnish employed.

Some very fine specimens of leather prepared in this manner were exhibited at the recent exhibition of French industry at Paris.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

Improvements in the Manufacture of Sulphuric Acid and Alum. JAMES THOMAS WILSON, of Glasgow. Sealed 28th March, 1849.

This invention consists in using a glass chamber instead of a leaden one, in the manufacture of sulphuric acid. The chamber is to be constructed of sheets or panes of glass, of a thickness indicated by one square foot weighing 16oz., and of any convenient length and breadth, supported in a suitable framework of yellow pine, free from knots. The bars have rebates cut in them to receive the panes, and are protected from the action of acid and heat by fillets of glass, which are cemented to their inside surface, and secured by means of glass pegs or screws. The joints between the panes themselves and between them and the fillets are ground so that they may fit closely together, and are, moreover, rendered perfectly air-tight by a luting being brushed over them. The cements and lutings must, of course, be such as will not be acted on by the acid or heat.

In manufacturing alum, according to Mr. Spence's process (patented in 1845), it has been customary to heat the liquors employed to digest the shale by passing steam through them when all are placed in the same vessel; but this method is attended with this inconvenience, that the liquid could never be raised to a temperature sufficiently high to dissolve all the shale. Mr. Wilson's improvements consist in heating the liquor in a separate vessel to 150° or 200° F., and then running it in upon the shale.

It has been usual to dilute the sulphuric acid with the mother liquors repeatedly, whereby a considerable portion of the acid has been thrown out and lost, in consequence of its combination with alumina and iron. The patentee, therefore, proposes mixing them with the ammoniacal liquor of the gas-works, thus forming sulphate of ammonia, which is afterwards mixed with the sulphate of alumina, whereby the fresh and previously formed alum is deposited.

Mr. Wilson claims:—

1. The use of glass, in pieces, frames, or sheets, to construct the chambers used by sulphuric acid makers, or other vessel used for the same purpose, of whatever form or size, so as to present to the interior a glass surface.

2. Heating the liquors employed in digesting shale in a separate vessel.

3. Mixing the mother liquors with ammoniacal liquors, so as to form sulphate of ammonia.

Improvements in the Manufacture of Materials for Lubricating Machinery. W. LITTLE. Sealed April 16, 1849.

These improvements consist in the application of the products of the distillation of petroleum as a lubricating agent, in combination with other materials. The petroleum is distilled in a retort, and the greasy products are mixed in the proportions of 45 parts to 32 parts of tallow, 75 parts of soda ley 10° to 11° Beaume), and 29 parts of water, when in the state of saponification.

The patentee claims the manufacture of lubricating matters for machinery by the application of the products of the distillation of petroleum.

Improvements in Extinguishing Fire, in the Preparation of Materials to be used for that purpose, and Improvements to assist in Saving Life and Property. W. H. PHILLIPS. Sealed April 16, 1849.

This invention refers: firstly, to the mode of constructing apparatus in which is generated the gas to be applied to extinguish fire, and which was the subject of a former patent; and, secondly, to the preparation of the material by the ignition of which the gas is to be generated.

The material, consisting of equal parts of chlorate of potassa and sugar, and moulded into a homogeneous mass, is placed in a perforated cylinder, within a second perforated cylinder, contained in a third cylinder, which is air tight, and the whole is enclosed in an outer case. Water is placed in the space between the bottom of the third cylinder and outer case, which is fitted with a vertical pipe, which opens into the space between the second and third cylinders, so that, as the metal expands by the action of the heat, the

water will be forced up the pipe, and made to mingle with the gas, which will afterwards escape through an opening in the top of the case. The "material" is ignited by driving a pin down into the midst of it. The patentee describes several modifications of the preceding apparatus, among which is one wherein steam is applied to exhaust the gas, and turpentine poured in to promote the combustion of the material.

Instead of mixing the materials with water, and moulding them into form, he proposes to boil them in water, and evaporate a portion of it, so that the mass may be in a plastic state, and easily moulded into the desired form.

Mr. Phillips claims this improvement in apparatus for extinguishing fire, and the mode of preparing the materials employed for that purpose.

Improvements in Preparing Wood for the purposes of Matches and Firewood. W. H. KNAPP. Sealed April 17, 1849.

This consists in immersing the wood in rosin oil.

A Method of Preserving from Destruction by Worms, Insects, Decay, and Fire, certain Vegetable and Animal Substances. LOUIS VERNET, Buenos Ayres. Sealed April 24, 1849.

This invention consists in impregnating, saturating, or coating the substance to be preserved with a weak solution of arsenic, alone or combined with other materials. The solution is made by boiling arsenious acid in water until it is dissolved. The proportion of arsenic to water is one pound to forty gallons. Care must be taken not to allow the fire to play on the sides of the vessel above the water, as it would cause the arsenic to sub-lime, which would injure the health of the workmen. The quantity of water evaporated should be replaced by the same amount of fresh water, in order that the relative proportions may be maintained. Or, a concentrated solution may be formed by dissolving one pound of arsenic in five gallons of water, which can be kept for any length of time in wooden vessels, until required for use, when every five gallons must be diluted with thirty-five gallons of water. The article may either be immersed in or washed over with the solution, and then dried, whereby, it will acquire a thin coating of arsenic, which will be imperceptible to the senses, but a sufficient preservation against the ravages of insects, &c. Or, it may be impregnated with the solution by exhaustion or pressure. When the solution is required to dry quickly, six pounds of alum to one pound of arsenic are dissolved in it.

To preserve timber from fire, it is to be impregnated with a solution of one pound of arsenic, six pounds of alum, and ten pounds of potassa, in forty gallons of water.

To preserve timber immersed in water from decay and the ravages of the worms, it is to be painted over with the solution mixed with oil or any suitable tarry matters.

The patentee claims :—

1. The use of weak, simple, arsenical solutions to preserve animal and vegetable substances from insects and decay.

2. The use of weak arsenical solutions in conjunction with other matters, or with oil or tar, to preserve animal and vegetable substances from fire and worms.

Improvements in Manufacturing or Treating Solvents of India-rubber and of other Gums and Substances. GEORGE SIMPSON, Newington-Butts, and THOMAS FOSTER, Streatham. Sealed, April 26, 1849.

1. Bisulphuret of carbon is placed in an iron still, the top of which opens into an earthenware vessel containing protochloride of antimony, and a pipe leads from the top of this vessel to the worm of an earthenware condenser. The still and first vessel are heated by steam jackets. The resulting product flows from the condenser to a reservoir, after which it is rectified by lime and is then ready for use as a solvent. Before rectification, the India-rubber, gutta percha, or other gum may be immersed in it, or exposed to its fumes, and thereby rendered less liable to injury from the effects of cold or heat.

2. Coal oil is purified and rendered applicable as a solvent of these gums by being subjected to a similar process, chloride of lime in solution being substituted for the protochloride of antimony.

The patentees claim :—

1. The manufacture of chloride and bichloride of carbon, and its application as a solvent of India-rubber, gutta percha, and other gums not soluble in water, and the mode of treating India-rubber as described.

2. The mode of treating coal oil with chloride of lime, for the purpose of obtaining a better solvent of the before-mentioned gum.

Improvements in the Manufacture of Sugar. ROBERT and JOHN OXLAND, Plymouth. Sealed, April 26, 1849.

The improvements of the Messrs. Oxland are confined to the defecation and decolorization of the sugar, and consist in the employ-

ment, for that purpose, of acetate of alumina. The mode of operation which they prefer is as follows:—The sugar is dissolved in water, and heated to 210° F. by steam, flowing through a flat coil of pipes. Carbonate of lime is mixed with this saccharine solution, to destroy the acidity; after which it is run through filter-bags with a shallower blow-up pan than was first used, when it is mixed with acetate of alumina, and boiled until nearly the whole of the acid is evolved, which can be ascertained by testing the steam with blue litmus paper. The pan is fitted with an air tight cover and pipe for conveying the acid fumes to a condenser, whereby they may again be rendered available for the manufacture of acetate of alumina; whatever quantity of acid may remain in the syrup after the evaporating process, is neutralised by the admixture of carbonate of lime. Cane and beet-root may be defecated by this process, either before or after concentration, and clarified by the employment of albumen, bullock's blood, or other well-known agent, in the usual way. The acetate of alumina is precipitated by the addition of tannin in solution. The acetate of alumina is prepared by mixing with a solution of sulphate of alumina a solution of soda ash, so as to produce an alkaline reaction on reddened litmus paper. The mixture is allowed to precipitate, and the clear liquid is decanted off. The precipitate is removed and washed repeatedly with water, until the hydrometer fails to indicate the presence of any soluble matter, the acid is then added in sufficient quantity, but not in excess, to form the acetate of alumina. The solution of tannin is composed of crushed valonia in water. The quantity of acetate which the patentees employ for 1 ton of average sugar is 4lbs.

The patentees claim the use of acetate of alumina in the defecation of saccharine solutions, and removal of colour during the refining of raw sugar.

Improvements in preventing Incrustation in Steam and other Boilers; also for Purifying, Filtering, and otherwise rendering Water fit for Drinkable Purposes. JOHN HORSLEY, Ryde, Isle of Wight. Sealed April 26, 1849.

The first branch of Mr. Horsley's invention consists in the employment of various well-known chemical agents to precipitate the calcareous and other "adventitious matters" held in suspension in the water. To "purify, filter, and otherwise render water fit for drinkable purposes," he draws off, by a syphon, the supernatant liquid from the precipitates.

Improvements in Extracting and Preparing Colouring from Orchil. ALPHONSE GARNIER, late of Paris, but now of South-street, Finsbury. Foreign communication. Sealed April 28, 1849.

M. Garnier remarks, that in extracting the colouring matter from lichens, according to the present mode, the lichens are bruised or crushed, and placed in a trough containing water, with the alkalies for extracting the color, where they remain for several months, until they assume the consistency of paste which contains, besides the tinctorial extract, ligneous particles, resinous and chlorophylous gums, and other unimportant substances. The object of the present invention is to separate the tinctorial from the foreign matter, previously to operating on it with chemical agents, by crushing the dye lichens, and washing, boiling, or distilling them to obtain a decoction, which is to be filtered for the purpose of separating the ligneous particles. Liquid deutochloride of tin is then added, and allowed to precipitate, after which the liquid is poured off, and the remaining precipitate is the substance from which the colouring matter is to be extracted by the application of known chemical agents.

The patentee claims the method of operating upon the colouring matter of dye lichens, or orchil alone with, chemical or physical agents, and obtaining it in a purer state.

Improvement in the Composition of Matters, applicable to substitute Oil in the lubrication of Machinery, and for other purposes. ALEXANDER MUNKITTRICH, Manchester. Sealed May 1, 1849.

This improved lubricating composition consists of 4lbs. of caoutchouc dissolved in some suitable solvent, 1lb of glue, 10lbs of carbonate of soda, 10 gallons of animal or vegetable oil, and 10 gallons of water. The water is boiled, the glue and soda dissolved therein, after which the caoutchouc and oil are added, and the whole well stirred together until it becomes as homogeneous and as fluent as oil. It is then ready for use, and may be stored in casks and bottles until wanted. Any substances possessing the same properties as the preceding, may be substituted for them, and when the caoutchouc and oil are previously purified, the carbonate of soda may be dispensed with; also, the proportions may be varied according to the degree of consistency required.

Improvement in Printing Calicoes and other Surfaces. JOHN DALTON, Hollingsworth, Cheshire. Sealed May 1, 1849.

Mr. Dalton states that the "lapping" or covering of the printing cylinder, and the

endless band of blanketing, used to sustain the fabric, are liable to great wear and tear from the abrasion of their surfaces, and to "flocking," which produces great unevenness of surface, and consequently of printing; and he proposes to remedy these disadvantages by coating the fabric employed, with a solution of gutta perchas, in the proportions of 5lb. of the gum to 1 gallon of solvent. The solution is placed in the color-box of the machine, which is made air-tight, and heated to 150° F. (in the case of benzole or bisulphuret of carbon being used, it is heated to 100° F., or to from 70° to 80° F. respectively). The solution is conveyed to printing cylinders, or, as it were, printed on the fabric by a roller placed between it and the color box, which is engraved with a reverse pen pattern, in order to press the solution into the fabric, which is afterwards carried over steam chests and steam drums, to volatilize the solvent, when the gutta percha will be found perfectly adherent to the fabric, or, the blanketting used to sustain the fabric during the printing, may be composed of two endless webs, having their opposite surfaces coated with the gutta percha solution, and afterwards united into one band by being subjected to pressure and heat.

The patentee claims:—

1. The novel combination of materials, their preparation and application to the lapping or covering of printing cylinders employed in printing calicoes, muslins, paper, and other surfaces, or any modification of them applicable to the same purpose.

2. The novel combination and preparation of materials, and their application to the endless web of blanketting employed in printing, or any modification applicable to the same purpose.

INACCURACY OF COMMERCIAL ASSAYERS.

To the Editors of the Chemist.

GENTLEMEN—There have been of late so many conflicting results in the analyses of cobalt, nickel, copper, manganese, and other ores, both in this and the Liverpool markets, that, connected as I am with some of the leading chemists, I feel it incumbent upon me, for their benefit and for the good of the public, to make a few remarks upon the subject in your valuable journal, especially as such discrepancies tend greatly to depreciate the value of science in the estimation of merchants, and all persons acquainted with these discordant results, and who are, consequently, now sending their samples to recognised professors of chemistry; men who would spurn giving a wrong result to suit any party, and who dare any one to whisper a breath against the integrity of their character.

It is to the interest of the seller to have the analyses of these ores, soda ash, bleaching powder, &c., made as high as possible, while, on the other hand, the buyer wishes to know if he gets the value for his money—*i.e.*, whether the commodity he purchases contains the per centage of ingredient represented by the vender.

Chemists—men versed in qualitative and quantitative analysis, and in the philosophy of the science—never differ in analysis. The combustion of sugar made by Dumas, Mitscherlich, Hoffman, Muspratt, and Kane, would give the formula C^{12} H^{11} O^{11}, and a mineral, analysed by the same chemists, would yield results *varying only from half to one per cent.* I intend to lay before your readers some extraordinary cases where a difference of five and even ten per cent. has occurred in an analysis *of the same ore*, and in samples of manganese, a difference of even twenty per cent. The first samples referred to are those of cobalt ores. I cannot do better than take an extract from a letter on "Commercial Testing," which appeared in the *Leeds Times* last month:—

"The determination of cobalt and nickel is the most difficult in mineral chemistry. Mr. C. E. Rawlins, jun., and others, who are large purchasers of nickel and cobalt ores, are well aware of the necessity of an accurate analysis; for a difference of four or five per cent. on an article worth 8d. or 9d. per pound might be a loss of hundreds of pounds to the purchaser. I believe that in some instances mistakes are not made intentionally, the fault being in the method. Some time since, a firm in this town sent me a cobalt ore for analysis, the result of which was that the mineral contained eight per cent. of oxide of cobalt. A few days after, their manager called upon me, and stated that another professor had found seventeen per cent. I would not repeat my analysis, being convinced of its accuracy. The sample, however, was forwarded to the Royal College of Chemistry, London, over which one of the most accurate chemists of Europe presides. The result thence corresponded with my own. By Liebig's or Rose's process the quantity of cobalt or nickel in ores can be accurately ascertained by any chemist possessed of ordinary capability. The following five determinations were obtained from an ore recently sent to my laboratory by Joshua Hegan and Co. It was analysed by three different chemists:—

Oxide of cobalt.
7·97
7·82
7·01
7·61
8·18

These results are sufficient evidence of the above statement."

With regard to manganese ores; samples which have been tested, 76, 78, and even 80 per cent., in the hands of *soi-disant* chemists, have, to my knowledge, turned out only 61 per cent. in the hands of experienced analysts. It is a remarkable fact, that the individuals who make manganese 78 per cent., and cobalt 17 per cent., *never get any one but the seller to agree with them*, while, on the other hand, in samples submitted to acknowledged scientific chemists *results always coincide*. I might bring a leading case to bear on this last assertion. I allude to the "Pimlico Sewer case." I have intended for some time to refer to this important subject; a subject intimately connected with our commerce, and also with science, but my manufacturing engagements have hitherto prevented me. The operations of the pseudo-chemists cannot be too much exposed, for by opening the eyes of those whose interests are connected with accurate analysis, the dignity of our science will be preserved, and a permanent good to the whole nation effected.

I am, gentlemen,
Most respectfully yours,
A TECHNOLOGIST, AND ONE WHO HAS SUFFERED FROM COMMERCIAL TESTING

London, Nov. 15, 1849.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

ON THE SALE OF POISONS.

PUBLIC attention is at the present time much occupied with considerations and discussions relative to the sale of poisons, and to the means of diminishing, if possible, the amount of crime committed with these agents—crimes which appear to have been greatly increasing during the last few years, especially since the establishment of burial clubs on a system which has had the effect of offering a premium for murder.

This highly-important question is variously treated by different persons, and several suggestions are before the public. Some propose to entirely prevent the sale, by retail, of arsenious acid (white arsenic) and several other popular poisons—others suggest that they should be sold only in presence of a witness; others, again, are of opinion that some such plan as adding some peculiar colouring matter would at last diminish the probability of their being taken by mistake—while all who have carefully studied this serious subject, candidly admit that none of these suggestions perfectly meet all the difficulties of this very difficult case, and agree that there exists a fatal facility in procuring poisons, whilst any enactment prohibiting the sale of a few individual poisons, would be productive of quite as much mischief as it would remove. For example, were the retail sale of arsenic prohibited, a person intending to destroy his own life or that of a fellow creature, unable to obtain this, would seek another, and with absolutely certain success. The family of poisons is so numerous that to forbid the sale of a few would be of little or no utility, especially when we reflect that we are surrounded by substances which exert poisonous action if taken in anything more than a limited quantity, and that it is scarcely necessary to apply to the druggist for them, as the fields contain many whose mortal properties a little study would enable the murderer or suicide to apply in a form suited to his odious purpose.

We are not of the number who imagine that this case can be fully met either by prohibition or by the presence of a witness. It is the imperative duty, and should be the anxious desire, of every vendor of such articles to ascertain that those whom he supplies understand the nature of the poison they purchase, and this he may do without preventing the useful application which are made of some of the poisons. We have no hesitation in expressing our firm conviction that where cases of poisoning occur in greatest number, there will be found among the sellers the greatest amount of ignorance and cupidity.

It is very questionable whether it would be expedient to entirely prohibit the sale of such a substance as arsenic, if the vendor would use that amount of caution which he ought to do, and whether it would be wise to prevent the commission of crime by an agent so readily discoverable, and thus, probably cause the employment of substances which for a long time might not be suspected, and whose existence in a body, even then, might not be easily proved, or, if so, only within a very short time after its administration. There are many poisons possessing these characters.

With regard to the suggested presence of a witness during the sale of a poison, if this were rendered compulsory, it would be necessary for a witness to be present at the sale of almost every medicinal substance, the most energetic of which are frequently required in cases of emergency, sometimes during the night, when it would be difficult, if not impracticable, to procure the attendance of a witness.

It appears to us to be a matter of the highest importance, in the endeavour to arrest the progress of this species of crime, to make detection as certain as possible, by the employment of medical and chemical testimony, which, as it should be required in all medico-legal investigations, if the selection of professional witnesses be carefully and judiciously made, would render it much more easy and certain than at present.

It is dreadful to contemplate the kind of scientific evidence with which judges and juries are sometimes satisfied. In a case which has recently occupied considerable attention, and whose horrors, of both crime and retribution are painfully fresh in the memory, a youth of 20 years of age, who called himself a practical chemist, was examined on a point most important to the wretched prisoners—one requiring considerable knowledge and experience.* We regard this as perfectly shocking, and as urgently demanding remedy at the hands of those whose duty it is to amend the laws. Even in a case involving pecuniary consideration, such evidence would not be attended to; why then should the life or death of human beings, be their guilt what it may, in any way depend on their knowledge, or rather absence of it?

It is our opinion that the most probable chance of success in attempting to put an end to criminal poisoning is to appoint, in different parts of the country, men capable of bringing to bear on such cases the true aid of science. For instance, a College of Chemistry has been started in Liverpool: that institution might be appointed for that town; security would then be given to the public, and the poisoner would be awed with the greater certainty of detection.

The more clearly it is proved to the public that chemistry is capable of discovering poisons after administration, the more people will be deterred from the commission of crime by their means. They might, and probably would, resort to mechanical means of murder, but these are generally more open to discovery.

We earnestly urge the public and our readers to consider this subject for themselves, and not to allow it to be converted into a job by the trucklers to Government officials, but to show in whom they have confidence, and to whom they would entrust such important duties.

It is a well known fact that those who are most thoroughly acquainted with a subject are much more careful in any statements they make on that subject than those who possess a mere "smattering;" ignorant people always have confidence in their knowledge, and sometimes this confidence is communicated to those with whom they come in contact. Real knowledge is retiring, and requires seeking out. To mistake impudence for knowledge is, indeed, a fatal error. While on this subject we cannot refrain from repeating a case related to us by our late esteemed friend, James Marsh, the discoverer of the ingenious method of detecting arsenic which some years ago attracted so much attention, and which is still the most worthy of reliance. He was retained in a case of poisoning by arsenic, supposed to have been committed by a servant. It appeared that

* It has been stated that the case alluded to has cost the county about 800*l*. Surely, it would have been better for the prosecution to have expended a little in obtaining the evidence of a respectable chemist.

there were two servants in the family—one a young girl. This girl had frequently solicited the upper servant to allow her to make the pudding, but was always refused, until one day when, from some circumstance, she was allowed what she considered the privilege of making it. The family partook of it, all were speedily taken ill, and some of them died. Many circumstances seemed to point out this girl as the murderess. She partook of none of the poison, which it appeared she had purchased some months before this sad event. Mr. Marsh analysed the contents of the stomachs and the vomited matters, as well as the portion of pudding unconsumed, and found arsenic in each of them. The girl was hanged asserting her innocence. Some time afterwards the eldest son was taken ill, and on being told that he was about to die, he confessed that he was the poisoner; he put the arsenic into the flour when the girl left the room, and as he never ate pies or puddings, his not doing so on the fatal occasion attracted no notice. His object in committing this diabolical crime was to obtain possession of the property which his father held. Poor James Marsh never forgot this painful case, and would have given anything to be able to recal his testimony, and could only console himself with the fact that the only duty he had had to perform was to ascertain the existence of the poison, and that he had nothing to do with how it came where it was found.

We earnestly hope that the subject of the sale of poisons will meet with the consideration which its importance demands. We shall carefully watch it, and resume our observations at an early opportunity.

SANITARY NOTES.

NO. III.

It is essentially necessary, in the proper sanitary economy of a town, that the public thoroughfares be kept always clean; that all those animal and vegetable substances which give out offensive gases in their decay should be removed; and, to attain this object effectually, it is necessary to have a plentiful supply of water for the purpose. It has been found by experience, in Birmingham and some parts of London, that a considerable saving is made in cleansing dirty roads by first watering them well, and then using the sweeping machine. By this plan, a saving of from 12 to 20 per cent. of the materials of the roads is effected, for an examination of the sweepings, after the use of water, shows scarcely any available grit, while, in the residue from a road swept without water, there is a considerable proportion of useful grit. A ton of water will suffice for about 600 square yards.

In the small courts, which abound in every town, there should be the means supplied of scouring the pavement every day by means of a hose. A rigid attention to this regulation would do much towards purifying the air in the more "dangerous[b]" parts of a town.

But, perhaps, the most important public purpose for which water is required is for the flushing of sewers. The plan hitherto adopted in London for flushing has been simply an aggravation of the evils of cesspools. A dam is made across a sewer, generally by means of a sluice-gate constructed for the purpose, to retain the sewage until it has acquired a sufficient depth to flow with some force; then the sluice-gate is opened, and away goes the boiling filth, stirring up all the sulphuretted, phosphoretted, and otheretted gases which have been generated below the sluice-gate, and driving them up every gully-hole and untrapped house drain on a mission of disease and death. It would be difficult, also, to imagine a more horrible or dangerous reservoir than that which is made to collect above the sluice-gate; the liquid filth and refuse is allowed to amass its putrefying horrors in a quiet still, increasing by almost insensible degrees, and throwing off with rapidity its steaming gases, which must find vent up the gullies and drains. Then the flow of such an infernal stream, when let loose, cannot be complete, so as to leave no trace behind it; the "bubbling scum" on the surface is left on the sides of the sewer, as the level gradually falls, and there continues to corrupt, until the whole of its death is sent up to multiply the deaths on the earth. I have no hesitation in asserting that the authors of the system of flushing prac-

tised in London have a heavy bill of indictment to answer to in the book of the nation's health-register. It is no answer to say that men high in authority and science agree to commend flushing as the cheapest and most decent method of cleansing sewers. It was but mockery to tell this to the wretched inhabitants of Bermondsey, who complained, with a unanimity as wonderful as it was painful, that, when their sewers were being flushed, their houses were barely habitable, owing to the intolerable stench from the drains. If Science says, such a matter is so, and Fact says it is not so, depend upon it Science is wrong—or, to speak more correctly, the professors of science are wrong, for everything in nature is nicely harmonised, and true science and fact cannot be at variance. Now, for the matter in question, it may be stated at once that, doubtless, "flushing is the cheapest and most decent method of cleansing sewers;" but it must be flushing with clean water, and not with rotting filth.

Tanks of clean water should be provided in convenient situations, connected by sluices with the sewers, and the flushing from this source should take place at regular and frequent intervals; and, at the same time, some means of innocuous escape for the foul gases should also be provided. A plan practised at Chester and Hull is, to connect the rain-water pipes on the house fronts with the sewers; and, as with a system of frequent clean water flushing, there would be but little foul gas generated; this plan might be sufficient, all other openings into the sewers being effectively trapped at the sewer end of each drain, and not the opposite end. At Chester it is proposed to carry out a plan similar to this, by connecting the "dead ends" of their sewers with the watermains.

There is a subject closely connected with the above, which is of the greatest importance both in a sanitary and an economical point of view, viz., the size of sewers; but the pages of this journal are, perhaps, hardly the most appropriate in which to discuss this question. It must, however, be obvious, that if a sewer is constructed much too large for the stream which it has to convey, that the larger substances which come away in the refuse of a house must frequently be left to rot and generate foul gas in the sewer, on account of the insufficiency of power in the stream to float it away; and in this way a subject otherwise belonging to pure engineering, becomes also an important item in the general "sanitary question."

With a good supply of water constantly in the mains, at a regular pressure, there need be but small danger from fire. In the "constant supply of towns of England and Scotland, at Hamburg and New York, hydrants are placed in the streets, sometimes in the shape of posts or the lower parts of the lamp-posts, on which a hose is readily screwed, and ready for action instantly. The advantages of this plan are two-fold: firstly, a fire may be extinguished before it has acquired any strength; and secondly, the means are afforded for washing the outsides of buildings. By this plan a church which was cleansed in London lately for the marvellously small sum of £30, might have been equally well cleansed for as many shillings.

A good "water supply" has not, however, completed its duties until it has afforded the "requisites" for a large number of fountains; the benefits derived from these novelties (to English eyes) is by no means confined to the artistic effect they produce. Their effects upon the surrounding atmosphere, promoting its circulation, cooling its heat, and assisting in its purification, are advantages of even higher importance, physically, than those others which refresh the weary and careworn eye of the hard-working citizen, and, perhaps, cheat his fancy for a moment with memories of lang-syne pleasure by the bubbling brooks and flowing streams of his younger days. A few minutes of these "cheated fancies" in each plodding day are sweet counterpoises to hours of toil in unventilated courts and houses, and are well worthy of promotion even for their sanitary effects.

It is satisfactory to observe that, in London, the question of an improved water-supply is not likely to be dropped. But let not the inhabitants of any town in the United Kingdom rest until they have good drainage and a constant supply of good water. Let them remember that in London, along the

southern shore of the Thames, where the ground is low and very ill drained, and where the water-supply (when there is any) is derived from the Thames, near or below Vauxhall-bridge, the cholera mortality during four months amounted to the rate of 14 deaths per 1,000 inhabitants—(in the worst locality it actually reached 20); while in the northern districts, lying on rising ground, generally well drained, and supplied with water from land springs in the sand or chalk of the outlying country, the mortality amounted only to 1½ deaths per 1,000 inhabitants; that in Birmingham, a town lying on a porous sandstone, with steep inclinations, and thus having a natural drainage, there was hardly a case of cholera; that in Nottingham, where, since 1832, a copious and constant supply of good water has been furnished to nine-tenths of the houses in the town, there has been no case of cholera; and then let them inquire what their own necessities are, and set earnestly to work to provide for them; and, in discussing the effects of the recent visitation in their own neighbourhood, as compared with its effects in other places, let them not do so "to illustrate how, by similar or worse circumstances, an equally great mortality may have been produced elsewhere, but rather to suggest how, by other and better sanitary arrangements, their own present high mortality may be diminished."

The following extract from M. Simon's most valuable report on the sanitary condition of the City of London, contains an epitome of the regulations which he states to be necessary, and which are really applicable to every large town in the country. It will be observed that they apply mainly to the poorer parts of the town, and therefore do not contain the whole sanitary requisites of a mixed community. (The first item is altered to have a more universal application than in the original). "To provide a complete and effective system for the removal of the sewage of the population; to give an indefinite extension, and a sounder principle to the system of water supply; to suppress all trades and occupations which taint the atmosphere with materials of organic decomposition; to abate the nuisance of smoke; to provide the facilities for extramural interment, and to procure the prohibition of all further burial amongst our living; to improve the domestic arrangements of the poor and to ensure their adequate supervision; to hinder the occupation of houses which breed pestilence; to destroy such as are irremediably hostile to health; and to thin the stifled population of courts and alleys; to establish public baths and laundries which may offer to the poor the utmost facilities and inducements for the maintenance of personal cleanliness; to erect in the stead of such courts as we may hope to depopulate and destroy, new houses, but in open streets and with perfect ventilation; to erect and place at the disposal of the labouring classes, houses and lodgings which not only may offer to their inhabitants every convenience essential to health and decency and comfort, but may likewise serve as models of household economy for the whole district in which they stand."

J. N. W.

THE ACTION OF METALLIC COMPOUNDS ON THE ORGANS AND TISSUES OF THE BODY.*

BY DR. JAMES SHERIDAN MUSPRATT,
Professor of the Liverpool Coll. of Chemistry.

THE few remarks which I now submit to you are on a very interesting subject, viz., the action of metallic compounds, but, more especially, on that of arsenious acid on the organs and tissues of the body. Liebig has proved that most of the metallic poisons combine with the animal tissues, forming compounds which are not susceptible of putrefaction; and that when taken into the system, these poisons act, not as poisons in the *limited sense of the term*, but, by combining with the animal tissues, forming bodies fixed in constitution, and, therefore, not partaking of those changes which every part of the animal system is continually undergoing; that is to say, the deadly effect of these proper inorganic poisons is owing to the *exercise of a chemical affinity between them and the animal tissues, more powerful than the vitality of those tissues.* If this view

* Communicated by the author.

were not a correct one, why can we not detect poisons, especially mineral poisons, without destroying the organic matter in combination with them? The abecedarian in chemistry knows that the presence of organic matter, in nearly every instance, veils chemical action, and until that organic matter is destroyed, no correct reactions can be obtained. One of the most simple and remarkable instances of the effect of organic matter in concealing chemical reactions is with salts of the sesquioxide of iron. Ammonia is always used to precipitate this oxide. It fails to do so, however, in the presence of fixed organic acids, sugar, &c. Why cannot arsenic be detected in the animal tissues? Because, by experiment, we have found that it has become an integral part of those tissues, and is held in combination by a stronger affinity than those substances which are applied to ascertain its presence have power to overcome. It is in the tissue, like the iron in ferrocyanide of potassium. Solutions of salts of lead, bismuth, copper, mercury, and iron, when mixed with a sufficient quantity of albumen, milk, muscular fibre, and animal membrane, *enter into combination with them*, and lose their own solubility; whilst the water in which they were dissolved loses all the salt which it contained. This is an experiment easily tried; it is a fact, and, therefore, proves the correctness of Liebig's views. The stomach absorbs a weak solution of common salt; but a strong solution absorbs the water from the stomach, producing thirst. Thus, the salts of alkaline bases extract water from animal substances, and the salts of the heavy oxides are extracted by animal matter, *entering into combination* with it. Chloride of mercury and arsenious acid possess, in a very high degree, the property of combining with all parts of animal and vegetal bodies, rendering them, at the same time, incapable of decay or putrefaction. It may, however, be asked what proof have we that these compounds are formed in the body under the influence of the *vis vitæ?* In reply, I affirm, that there is proof of their being formed, and *no proof* that they are not. It is well known to every chemist that, within the last few years, there have been formed in the laboratory, *without the aid of the vis vitæ*, many substances previously considered to be the exclusive production of the vital process. *Urea* has been artificially produced, and, by oxidising uric acid, we form *allantoin*, a crystallizable matter existing in the allantoic fluid of the cow. Salicine and fousel oil, when properly treated with substances rich in oxygen, furnish us with acids produced in the process of the vegetation of *Spirea Ulmaria* and *Valeriana Officinalis;* and no sooner were the chemical properties of the volatile oil of *Gaultheria Procumbens* known, than its artificial production succeeded immediately in the hands of the chemist.

We can make grape sugar in the laboratory of precisely the same nature as that formed in the vegetative process, and starch found in the cells of plants is of the same nature as that formed in a laboratory. Again, it has been well established that food has been made to undergo digestion by artificial means, thus dispensing with the vital force. With these incontrovertible facts before us, is it not better to endeavor to discover the causes of the phenomena of life, than to seek umbrage under a *certain something* existing only in the imagination, and which is created for the purpose of veiling our ignorance by giving an imaginary explanation, which a practical mind repudiates? We must bear in mind that organic chemistry is as yet only in its infancy, but if in its commencement it has to so great an extent unravelled the mystery of the vital force as to produce substances previously produced only by the hand of nature, it is not too much to hope that before long the mystery of life, so far as it can be fathomed by our researches, will be satisfactorily explained. I have already stated that chloride of mercury and arsenious acid possess in an eminent degree the property of combining with all parts of animal and vegetal bodies, forming persistent compounds; and, mark the similarity, those parts of the body coming into contact with these substances during poisoning, and which, therefore, enter into combination with them, do not afterwards putrefy. The only reasonable inference to be drawn from this fact is, that the chemical action is precisely the same as when performed in the laboratory. Insoluble compounds of arsenic have not the power of entering into combination with the tissues of the organism, and are therefore *not poisonous even in large doses.* Kakodylic acid $C^4\ H^6\ As\ O^3$ is not poisonous, and, what is exceedingly interesting, it approximates very closely in composition to the *organic arsenical compounds found in the body.* Müller has shown in his admirable experiments that the equivalent in which fibrine combines with hydrochloric acid, and with the oxides of lead and copper is expressed by the number 6361. This shows the remarkably high atomic weights of organic substances, and it also explains why small quantities of arsenious acid and chloride of mercury produce deadly effects. When poisoning is superficial an eschar is formed which

is readily thrown off, especially if the physician immediately administers an antidote to cause those particles of the poison still free to form an innocuous combination. Salts of copper, when in combination with the most powerful acids, are reduced by many vegetal substances either into metallic copper or sub-oxide of copper, neither of which enter into combination with animal matter. Hence sugar is such an excellent antidote in cases of poisoning by salts of copper. We find, then, that the views of Liebig are supported by experiment, by which assertion is not unfrequently rendered powerless and entirely destroyed.

Now let us enquire who are the supporters of this theory. Their name is *Legion*—amongst the foremost we find Müller and Schleiden, the great German physiologists, whose names alone are a host, and the first chemists and physiologists of the age coincide with these views.

Sir Robert Kane, a medical man, and one of the first chemists of the day, has the following in the new edition of his "Elements of Chemistry"—in fact, Liebig's theory in other words:—"From the greater complexity of composition of animal substances, their de-composition is more rapid, and its products more diverse than in the case of organic bodies of vegetable origin; and whilst the carbon, hydrogen, and oxygen, give origin to various kinds of albumen and other substances of the same class, the nitrogen is generally evolved as ammonia, and the sulphur as sulphuretted hydrogen. It is the presence of these bodies that gives to putrefying animal substances the disagreeable odor by which that process is distinguished from mere mouldering or rotting. Even during life the constituent particles of the body are in a continual state of change, being absorbed and thrown out of the system, whilst others are assimilated in their place. Any part of our constituents, liquid or solid, which becomes unfitted for this vital function is thereby killed, and must, if not gotten rid of, induce the death of the individual. Hence, precisely the same means which give to animal substances the fixity of constitution which belongs to true chemical compounds, and thus preserve them from de-composition by the disturbing action of their own elements (as when we coagulate albumen by an acid, by corrosive sublimate, or by oxide of copper), produce, if applied to the living body, the death of the part, or of the whole being, by depriving the blood, or the tissue, of the mutability of constitution which is required for the functions of the animal frame. It is thus that the generality of metallic poisons act in producing death. Being absorbed into the system they unite with the albumen and fibrin of the blood, and converting them into the insoluble compounds which we form in the laboratory, unfit them for the continual absorbtive and secretive offices, which, as organs, whilst they live they must fulfil. If the injury be local and limited in extent, the part so coagulated may be thrown off, and, after a certain time, the functions return to their proper order. If the mass, or the importance of the affected parts be greater, the system cannot so get rid of the portions which have thus been removed from the agency of life to submit to merely chemical laws; on the contrary, the vital powers of the remaining portions of the animal are so much weakened in the effort that general death is caused."

I have been induced to make these few observations, from having seen a statement in various periodicals and scientific journals, that "the views of Liebig, with respect to the action of poisons, are fallacious and absurd." Seeing nothing but *assertion*, and the grand test of experiment not having been resorted to, I thought it proper to bring before you the *facts* of the case, supported as they are by the experiments and experience of some of the first chemists of the age. The views of Liebig are of such a nature as to bear the strictest investigation. They have been submitted to the furnace of experiment, and, like the noble metals, have come out intact; therefore, if his theories are to be refuted, let it be by analysis and not by assertion.

NATURAL HISTORY OF QUINQUINAS.*

BY DR. WEDDELL.

(*Continued from page* 86.)

The quinquinas very rarely form entire woods of themselves; but they may form thick groups, scattered here and there over the forest. The Peruvians give them the name of *monchas*, or "spots." Sometimes, and indeed most commonly, they grow completely separate. However, it is to discover them that the *cascarillero* exerts all his skill. If the position is favorable, he regards the top of the trees; he can then, by the slightest indications, recognise the presence of that which he seeks; a slight quivering, and a peculiar color, proper to the leaves of certain species, the appearance produced by a great mass of *inflorescences*,

* *Journal de Pharmacie*, Sept., 1849.

enable him to recognise the top of the quinquina at an immense distance. In other circumstances, he contents himself with examining the trunks, whose external layer of bark, or *enves*, as it is called, presents remarkable characters. Frequently, also, the dried leaves which lie on the ground suffice to point out to him the vicinity of the object of his search; and if they have been carried by the wind, he will know from what direction they come. It is most interesting to behold an Indian at such *a moment*; running in and out of the *small inlets* of the forest, darting his eye through the foliage, or seeming to scent the earth, he proceeds like an animal pursuing its prey, hastening suddenly when he recognises the form he watched, and stopping only at the foot of the trunk whose presence he had, so to speak, divined. Many things, however, are necessary that the searches of the *cascarillero* be always followed by a favorable result; too often he returns to the camp with empty hands, and his provisions exhausted; and, sometimes, when he has discovered on the side of the mountain the indication of the tree, finds himself separated from it by a stream, or by an abyss. Days may then elapse before he reaches an object, of which, during that time, he scarcely loses sight.

To deprive the tree of its bark, it is cut down a little above its root, taking care, in order to lose nothing, first to denude it at the point at which it is to be cut; and as the thickest, and, consequently, the most profitable part is found at the base, it is customary to dig out the earth from round about it, in order that the decortication may be complete; it is rare, even when the cutting of the trunk is completed, that the tree falls immediately, being sustained either by clinging plants, or by the neighboring trees; these are additional obstacles which the *cascarillero* must overcome. I remember once having cut a large trunk of quinquina, in the hope of bringing its flowers within my reach, and, after having cut down three neighbouring trees, having seen it still remain standing, being supported in this position by the climbing plants which were attached to its top.

When the tree is at length brought down, and when the branches which may have entangled it have been cut away, and the peridermis made to fall off by striking it with a small wooden mallet, or even with the back of the axe, and the living part of the bark exposed is sometimes cleaned with a brush; then being divided throughout its thickness by uniform incisions, which circumscribe the pieces to be removed, it is separated from the trunk by means of an ordinary knife, or some other instrument, with the point of which the surface of the wood is shaved as much as possible, after having been penetrated by one of the incisions already made; and if the position of the trunk prevents all the bark from being obtained in this first operation, it is cut in pieces, in order to be able to turn it. The dimensions and regularity of the pieces necessarily depend more or less on circumstances; in general, however, for convenience of transit, and facility of preparation, they are made of the length of 15 to 18 inches, and of the breadth of 5 inches. The bark of the branches is separated like that of the trunk, except that it is not stripped—custom requiring that its external crust or peridermis be retained.*

* Formerly, with rare exceptions, bark deprived of its peridermis was refused in commerce; not that any virtue was supposed to exist in it, but it furnished distinctive characters more easily recognised, and at the same time more difficult to falsify. The necessity which the *cascarilleros* were under of preserving this peridermis, which is very frail in some species, required particular care on their part. Thus, in many places, it was customary to fell the tree two or three days before stripping it of bark, in order that by allowing desiccation to commence, the different layers of bark might adhere more together. I believe, however, that the custom of removing the peridermis or *enves* of large barks at the moment of extraction is not entirely general. Some quinquinas from New Granada, which I have recently had an opportunity of seeing, were still covered with the peridermis. Be this as it may, it is evidently necessary to study this bark under both conditions. I am persuaded that many specimens in the Museum, collected at a time while the peridermis was still in fashion, would not be banished in the *incertæ sidis*, if submitted to this proof, and *vice versâ*. The process formerly employed for separating the young bark from the wood differed also from that at present in use; whence results a certain difference in the conformation of the cylinders performed by these two methods. I have already described that now employed, and it is easy to comprehend that by this means the pieces removed may be of dimensions in accordance with the patience and skill of the *cascarillero*, or of the circumference of the branch or trunk operated on. Formerly, on the contrary, the strips of bark were removed by a single cut down to the wood, the *cascarillero* holding his knife by its two ends and rapidly cutting towards himself. The ribands obtained in

The drying process varies a little in these two cases; indeed, the smaller pieces of the bark of the branches, or of the small trunks, intended to make the tubed quinquina, are exposed simply to the sun, and of themselves, take the desired form, which is that of a hollow cylinder; but those which arise from the large trunks, and which are intended to constitute the flat quinquina, or, as it is called, *tabla*, or *plancha*, must necessarily be submitted to a certain pressure during desiccation, without which they would be more or less twisted and rolled up like the foregoing. For this purpose, after the first exposure to the sun, they are arranged on one another in crossed squares, as planks are placed in some timber yards, in order that they may be kept flat; and on the pile thus formed is placed some heavy weight. Next day, the bark is replaced for some time in the sun, then again in the press, and so on; the drying is completed in the press.

I have just described the most ordinary manner of preparing the quinquina, but it will be readily understood that it must be varied according to the localities, or the nature of the tree operated on. In many places, the barks are not pressed at all, or only imperfectly; these may, therefore, be twisted, or begin to roll up. The peridermis is often only incompletely removed, or simply scraped. Frequently, indeed, either accidentally or designedly, to increase the weight, there remains in the bark a certain amount of moisture, which, in the end, always injures it. Hence quinquinas, having the appearance of having been prepared in the same manner, may, according to circumstances, differ very considerably. Under all circumstances, the work of the *cascarillero* is scarcely ever finished, even when he has completed the preparation of his bark; he must then convey his harvest to the camp, and with a heavy burthen on his shoulders, must repass those very paths which, when free from encumbrance, he traverses with such difficulty. This part of the extraction sometimes costs so much painful labor that no accurate idea of it can be formed. I have seen more than one district in which it is necessary for the quinquina to be carried for fifteen or twenty days before leaving the woods; and on seeing what price was paid for it, I could scarcely conceive how men could be found so distressed as to consent to follow an employment so badly remunerated.*

I must say a few words on the packing of the quinquinas, which is in the care of the

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this manner must necessarily be so much the straighter as they were taken from the trunks or from the smaller branches, and the tubes which they formed in drying were often only of the size of a quill. Moreover, their edges were always sharp, and their greatest thickness at the middle of their breadth. The defect of this method was the immense loss which resulted from it; for it was necessary to leave as much bark on the wood as was taken from it, as the intermediate slips, being already deprived of peridermis, were regarded as useless. But this cause of loss is still less than that which yet remains for me to notice. I allude to the almost complete abandonment for some time of the large trunks of quinquinas. The evil which results from this is immense. Men of the highest capacity having, indeed, stated that with age the juices gradually disappear from the bark, and that they were efficacious only in the barks of branches of medium size; all those which exceeded a given size were rejected, and it consequently became necessary, in order to procure the quantity of quinquina required for consumption, to sacrifice four times as many trees as would have been sufficient in another state of things. It was said, it is true, that the *cascarilleros* climbed on the quinquinas to cut off the branches, taking care to leave the terminal branch; but the *cascarilleros* whom I have known have always candidly avowed that they found it much more simple to cut down the tree, and this is, I think, done everywhere. Millions of quintals of quinquina were thus left to rot in the forests, and it was only when chemical analysis had demonstrated the inutility of the principle that this waste ceased. It must not be supposed, however, that the very old barks contain so much of the active principle as those which may be called ripe barks. But there are limits between which all are good; none, at any rate, should be rejected.

* In general, before the produce arrives at the coast, it has passed through at least three or four different hands; and as each time that it changes proprietor, something is added to the price, the carriage, moreover, being very expensive, it follows that the price of quinquina in Europe can give no idea of what it costs in its native forests. Pelechuco, for example, the kilogramme of the best quality costs only 1 franc 50 centimes, and for the same the manufacturers in Paris now pay 20 francs. In other parts I have seen from 6 and even 4 piastres (30 and 20 francs) paid for the quintal of ordinary quinquinas, a sum of which the working *cascarillero*, who is paid by task work, receives at most two-thirds.

majordomo. The cutters bring him the bark, he has it picked, in order to reject the bad, submits it to a fresh desiccation, if necessary, and forms bundles of them of nearly equal weight, which are sewn up in large woollen bags brought on purpose. In this condition the packages are conveyed on the backs of men, asses, or mules, to depots in the towns, where they are in general enveloped in an external covering of untanned hide, which acquires great solidity in drying. Under this form they are known by the name of *surons*, and it is thus that they come to us in Europe. . Their ordinary weight is from 70 to 80 kilogrammes, but some are also of less weight. From these details, we perceive how incorrect are the ideas which many people still hold concerning the extraction of quinquina, either in supposing that it continues to be subject to a special surveillance, as there was formerly a pretence of doing, or in imagining that these trees are cultivated in closed parks, and treated like oak bark in this part of the world. It must be acknowledged that the mode of working this valuable product seems to be always at the mercy of the demi-savages who practise it; and if we do not find some means of counter-balancing this destructive power, our descendants will inevitably have the misfortune, if not of seeing the different races of quinquina become, if not extinct, at any rate extremely rare. The opinion of those who see the forests refilled with seed plants, and the shoots growing out of the stumps of the trees is, indeed, correct; but, as is evident, it can be verified only to a certain extent. Too often, indeed, the stump, destroyed without discernment, dies with the trunk it bore; and the shoots, when they are produced, when they have very slowly arrived at a certain size, are cut down. It is the same with the seed plants. A surveillance over the workmen, by means of inspectors, would, to a certain extent, prevent these ravages; but such a system, unfortunately, could exist only in theory. There is a great difference, indeed, between an inspector of woods in our country and an inspector of a forest in New Granada, especially if this forest extends over a surface of twenty thousand square leagues.

Two systems alone appear to me capable of being adopted for preventing the rapid disappearance of the quinquina trees; one is, to limit the exportation to an amount proportionate to the productive power of the forests; the second is, to make it the subject of regular cultivation. To limit the exportation would be, doubtless, the most certain, but is it not to be feared that the disproportion between the consumption and production is already too great for it to be possible to re-establish the balance, and have not our wants become too imperative to yield to considerations affecting only a distant future?* The only resource is cultivation, and it must be employed. If any tree be worthy of being acclimated in a French colony, the quinquina tree certainly is, and posterity would bless those who put such an idea into execution.

ON ATROPINE.†

BY DRS. BOUCHARDAT AND STUART COOPER.

THE authors recommended the substitution of atropine for belladonna, in order to obviate the uncertainty of the operation of the latter. The dose can be increased from two milligrammes to one centigramme (about $\frac{1}{100}$ths to $\frac{6}{10}$ths of a grain troy.

The local pain caused by atropine when endermically applied is only of short duration, and is not accompanied by any bad consequences. Internally, atropine may be given in the following forms:—

I. *Tinctura atropini.*—One gramme of atropini dissolved in 100 grammes of spirits of wine of 85 per cent.; one drop of this solution contains about half a milligramme of atropine. The dose is ten drops.

II. *Syrupus atropini.*—One decigramme of atropine dissolved in ten grammes of water, acidulated with one drop of muriatic acid, and mixed with 100 drops of simple syrup. In 100 grammes of this syrup is contained one centigramme of atropine. The dose is 20 grammes.

III. *Pulvis atropini.*—One centigramme

* In support of this view, it will be sufficient for me to quote the example of the company of Paz, to which the Bolivian government granted the monopoly of the quinquina trade of Bolivia, with the power of exporting 4,000 quintals, or 40,000 Spanish pounds, and which could not be contented with this large quantity, and is now accused of having considerably exceeded its rights. How would it be, then, if these restrictions were entirely removed, as everywhere else, and especially in Peru, where the exportations, in some years, have amounted to truly wonderful quantities.

In New Granada, when the rage for working the barks was at its height, that is to say, at the beginning of the present century, the quantity of bark exported from the single port of Carthagena amounted, in 1806 alone, to the enormous quantity of 1,200,000 lbs. weight. Now, on the contrary, only a few *arrobes* are exported.

† *Pharmaceutical Journal*, Nov. 1, 1849.

of atropine mixed with two grammes of sugar, and divided into twenty equal parts. Each powder contains half a milligramme of atropine. Children of five years old may take, in hooping-cough, two or three such powders daily.

IV. *Pilulæ atropini.*—Five centigrammes of atropine, mixed with pulo. rad. althœæ, and a small quantity of honey, may be made into fifty pills, and one or two given for a dose.

V. *Collyrium atropini.*—One decigramme of atropine dissolved in 100 grammes of distilled water. *Collyrium atropini fortuis* is prepared with five centrigrammes of atropine, and twenty grammes of distilled water. For dilating the pupil one or two drops are to be introduced into the eye.

Bouchardat recommends the following method of preparing atropine. The atropine is to be precipitated by a watery solution of iodine in iodide of potassium, and the iodurretted hydriodate of atropine decomposed by zinc and water. The metallic oxide is separated by means of carbonate of potassa, and the alkaloid dissolved in alcohol.

Rabbits are scarcely affected by atropine. Dogs are soon poisoned by it. On man the effect is much stronger. One centigramme is able to produce the following symptoms: At first, acceleration of the pulse by eight to twenty strokes; after thirty to fifty minutes, an affection of the brain is produced. The first and most constant symptom is dry throat with difficulty of swallowing. The second is dilatation of pupils, with increased power of vision; also giddiness, noise in the ears, hallucination, delirium, stranguary, with incapacity of emitting the urine; a sensation of formication in the arms, rigidity of the thighs, depression of the pulse. The unfavorable symptoms disappear after twelve to twenty hours. The sanitary effect of atropine has chiefly been substantiated in chorea and other chronic nervous diseases.

ON THE VANILLA OF THE ISLAND OF BOURBON.*

BY M. BOUCHARDAT.

VANILLA comes to us chiefly from the maritime parts of Mexico; it grows also on the banks of creeks sheltered by the mango trees, which are sometimes overflowed by the high tides, in Columbia and Guiana; endeavors have also been made to cultivate it in Cayenne, Santo Domingo, and the Isle of France. These attempts have also been followed at different times in the Island of Bourbon. M. Menier has recently received two boxes of vanilla from this colony; he has sent me a sample of it which affords me the opportunity of making these observations.

The vanilla of the Island of Bourbon is certainly furnished by the same vegetable as gives it in Mexico. The husks are similar in all essential characters; they are of the height of 15 to 18 centimetres, and from 6 to 8 in thickness, shrivelled, furrowed longitudinally, shrunk at each end and curved at their base. These husks are rather soft, viscid, and of a reddish-brown color; they possess in a high degree the characteristic odor of vanilla; they *givrent* with ease.

The Bourbon vanilla differs from Mexican only in the less essential points as follows: it is generally less étoffée, shortened by 1 or 2 centimetres, and thinner by 1 or 2 millimeters. Its color is redder and less brown; it is dryer and less unctuous. It is chiefly the extremities which are dried up and contracted, and which are most deficient in that suppleness which distinguishes the Mexican vanilla. These differences, which are very slight, are sufficient to depreciate the commercial value of Bourbon vanilla; I am convinced that they are attributable to the mode of preparation or preservation, for example, the manner in which the husks have been dried and covered with a layer of oil. But for actual use, I have ascertained that this vanilla is in no respect inferior to the best commercial vanillas.

It has long been known that on account of the high price of vanilla, its culture has long been a matter of much interest; I will show further on, that the applications of this admirable aromatic are more important than they are commonly considered. But the difficulties must be greater than anticipated for this culture, in different countries, to be still a matter of experiment.

However, in the green-houses of Liége, M. Morren has obtained good results in the cultivation of vanilla; he states that the different stems which he has cultivated have produced him 600 francs (£24) in one year. One plant, grown in the green-house of the Museum at Paris, which was more than 3 metres in height, gave, in 1840, 117 husks of vanilla of the sweetest odor, which ripened only at the end of the year.

The principal difficulties in the cultivation of vanilla are:—1. Proper selection of species of the best variety; 2. The necessity for a high temperature; 3. Determination of the conditions most favorable for the development of this plant; 4. The good preparation of the husks.

We are not yet perfectly and indubitably acquainted with the species or variety which

* *Repertoire de Pharmacie.*

furnishes the best vanilla of commerce. The *vanilla aromatica* of Swartz, figured by Plummier, a figure related by Linnæus in his epidendrum vanilla, does not appear to be the origin of the vanilla of commerce. Indeed, Plummier says, that his plant, which is from Santo Domingo, is without odor, its fruits are small, thin, and cylindrical; they do not, therefore, resemble vanilla. On the other hand, MM. Splitgerber and Morren assert that the long vanilla of commerce is furnished by the vanilla planifolice. What gives great probability to this opinion is, that this same species, cultivated in the green-houses of Liege and Paris, artificially fecundated by the pollen of another species, furnished husks comparable to those of the best commercial vanilla. It is evident, therefore, that there are still doubts to be cleared up as to the best species or variety to be cultivated.

The necessity for a high temperature confines it to the green-houses, which should be fine, large, and airy ones. Except in special cases, we cannot, for this reason, hope for profit from this culture.

The conditions most favorable to the development and fructification of vanilla are far from being properly appreciated. We know all the difficulties which the cultivation of the orchidiæ presents; that of vanilla seems more difficult than that of others of the same family. Its stalks are provided with adventitious roots, which implant themselves in the bark of the mango trees, periodically watered by the high tides. May not vanilla require, for its proper development, this tree or one congeneric to it, favorable to its parasitism? May not the salts of the sea likewise be favorable to the development of mangoes, and, consequently, to that of vanilla?

In the Isle of Bourbon and in Guiana the principal conditions which I have just pointed out may be easily fulfilled. I think, therefore, that the cultivation of vanilla ought to be regular and certain, and I am confident that the consumption would keep pace with the production. I am about to study this latter subject.

I entirely coincide with the opinion of MM. Merat and De Lens, who say ("Dictionnaire de Matiere Medicale," t. VI., p. 842) that "Vanilla, added to many of our foods, imparts to them admirable delicacy and sweetness, and renders them proper for re-establishing the digestive powers when they are relaxed." I may add, that vanilla contains a balsamic oil, which possesses valuable properties (which M. Deschamps has found in the buds of the poplar and in benzoïn), opposing the rancidity of fatty bodies. The double utility of vanilla in chocolate is, therefore, evident. Taking into consideration the delicious flavor of this aromatic, it is certain that much profit might be derived from it for preserving food if its price were moderate and regular. The sweetness of its perfume recommends it in pharmacy for disguising the rancidity of several pommades.

ON OIL OF COPAIVA.*

BY C. J. MITSCHERLICH.

MITSCHERLICH has made a number of experiments with the oil of copaiva, and found that the effects of it are similar to, but much milder than, those of the oils of lemon and turpentine. Oil of copaiva is, of all the volatile oils yet examined, the feeblest poison, for though from six drachms to one ounce of it introduced into the stomach of rabbits caused, in full-grown rabbits, considerable illness, it did not produce death. Young animals died within from 11 to 28 hours after one ounce.

The oil of copaiva is absorbed from the stomach. Immediately after death has taken place, it can be detected by the odor in the abdomen, but not in the blood. The urine acquires a strong odor of the oil. The experiments on the odor of the breath cannot be relied on, as, by the introduction of the oil through the mouth, the latter is easily soiled by it, and then acquires the smell of the oil.

The volatile oil of copaiva, moreover, causes a similar change in the organism to that produced by the oils of lemon, turpentine, and juniper. The stomach is neither inflamed nor reddened: in one case, small blood discs were perceived in it; in another instance, the innermost layer of the glandular coat was softened. The small intestine is so far changed that its epithelium was removed, and converted into mucus. The large intestine was, in one instance, when the oil did not reach it, perfectly normal. In another case, when the oil had reached it, no epithelium was perceived, and one spot was inflamed.

The chief symptoms in cases of poisoning with oil of copaiva are frequent, but not very powerful pulsations of the heart, greatly accelerated respiration, frequent emission of urine, mostly in small quantities, frequent excretions of fæces, which are at first shaped, but afterwards pasty, and at last mucous, and mixed with blood. Muscular weakness increases; in most cases, a diminished sensibility, slow respiration, frequent and very feeble pulsation of the heart,

* *Pharmaceutical Journal*, Nov., 1849.

lying on the side, and death, without convulsions. It appears that death was produced by the passage of the oil into the blood, and not from the bowels.

Upon the skin of man the oil of copaiva is much weaker than that of the oils of lemon and turpentine, and weaker than that of the oil of juniper. In one case, where a spot on the back of the hand was moistened for an hour with the oil, no burning was experienced; in another case, a very slight burning was felt only at last.

The oils of lemon, turpentine, juniper, and copaiva, agree in their per centage composition, the equivalents of carbon and hydrogen being in each as five to four. They greatly resemble one another in their pharmacological effects, but differ materially from the other volatile oils, which have a different composition.

The volatile oils of mustard, fennel, carraway, cinnamon, nutmeg, and bitter almonds, in large doses, excite the vascular system and the respiratory organs. They produce diarrhœa, increase more or less the secretion of the urine, and cause death, with very similar symptoms.

The volatile oil of savine differs from the foregoing in being a much stronger poison, causing no diarrhœa, and acting more violently on the kidneys.

ON A CASE OF DEATH FROM THE USE OF A TOBACCO ENEMA.*

BY PETER EADE, ESQ., M.D., M.R.C.S., ETC.

F. B——, aged eighteen, an hysterical-looking girl, not having had any evacuation from the bowels for some considerable period, and various remedies, as well as repeated enemata, having failed to produce any effect, was persuaded by a friend, who stated to her that she had derived the greatest advantage from such treatment, to have a tobacco clyster administered.

For this purpose about three drachms of common shag tobacco was boiled in a pint of water, and injected into the bowels. In about half an hour after this she complained of faintness and feeling sick, and, in half an hour more, became quite collapsed, with cold sweats—vomited—was slightly convulsed—and she died in about half an hour, being an hour and a half from the time of the injection being administered.

Post Mortem Examination, Thirty-six Hours After.—The body presented no remarkable appearance externally. *Head*—Not examined. *Chest*—Lungs normal in every respect; no fluid in the pericardium, but the heart itself remarkably flaccid, so much so, that when laid upon the table it quite collapsed, and became almost as flat as an empty stomach in the same situation; all its cavities very empty, but in each of the ventricles from two to three drachms of fluid black blood. *Abdomen*—Liver presented no unusual appearance; stomach contained several ounces of semi-fluid food. Intestines examined for nearly their whole length; duodenum and jejunum empty; ileum contained some semi-fluid fæces; colon empty, and rather distended with gas. No redness or trace of inflammation visible in any part of the canal, and no smell of tobacco perceptible in the abdomen or any part of the body.

Blofield, Norfolk, Sept., 1849.

* *The Lancet*, Nov. 3rd, 1849.

MONOHYDRATED NITRIC ACID EMPLOYED AS A CAUSTIC.*

BY M. RIVALLIER.

This caustic is formed by a compound, a kind of combination of lint or wadding and monohydrated nitric acid. When a little ball of lint or wadding is steeped in nitric acid, it partly dissolves in it, forming a sort of jelly very like collodium. This jelly constitutes an excellent caustic, which has the following advantages over Vienna caustic:—

1st. It is more easy to accurately limit its action, especially when applied on inclined surfaces, for it does not liquify like potassa, which runs down as soon as it has absorbed water from the tissues.

2nd. It produces deeper eschars, and in less time.

3rd. Finally—and this advantage partly explains the foregoing—these eschars are soft and gelatinous, which prevents their opposing, or, at least, making much resistance to the action of the caustic on the tissues beneath them. The softness of the eschars admits of their being removed with a spatula as soon as they are produced, and thus also of the first cauterisation being carried, without being obliged to await their falling off, which is sometimes a long time, exactly as far as desired.

BOSQUET'S HIGHDROID SOLUTION OF OPIUM.

This is a fine very preparation; we have tried its effects on ourselves (happening to require it) and others, and can bear full testimony to its efficacy. The dose is the same as the tincture of the London pharmacopœia.

* *Journal de Chimie Medicale*, Nov., 1849.

GENUINE COD LIVER OIL.

In our number for October we acknowledged the receipt of samples of cod liver oil from Messrs. Langton, Brothers, and Scott. These samples we have since examined, and we have much pleasure in adding our testimony to those already published in its favor. It is unnecessary for us to enter into a description of this oil, as the certificates (signed by Mr. Arthur Aikin and Dr. Alfred S. Taylor, which we published, page 43) gives accurately all the characters by which it is distinguished.

In addition to submitting the oil to chemical investigation, we have tried it in several cases, and with great success. We regard cod liver oil as a highly valuable remedial agent, and we are convinced that its employment will daily increase, and that, unlike many new medicines, it will stand the test of time.

We may add that Messrs. Langton and Co. prepare their oil at Newfoundland, and, we understand that they operate on the fresh livers, which is the cause of the oil prepared by them being so free from disagreeable odor. This enterprise of Messrs. Langton merits the highest encouragement, and the introduction of so important a substance of such superior quality entitles them to the thanks of the profession.

ANALYSIS OF CONCRETIONS FOUND BY DR. MERAT IN THE URINARY VESSELS OF THE KIDNEY OF AN OX.*

BY M. CHEVREUIL.

None of these concretions were apparently homogeneous, one of them had the crystalline appearance of ammoniaco-magnesian phosphate.

Water removed a small quantity of alkaline salt and chloride of sodium; there was an odor of beef; this odor is found in several liquids of this animal, the bile, the liquid part of the meat, &c.

Boiling alcohol separated a phosphuretted oil analogous to that which I found in the blood, and which appears to me similar to the fat matter of the brain; there was, besides the odorous principle.

I proved the absence of uric and oxalic acid from these concretions and the presence of ammonia. When pulverised, and treated with nitric acid, weak at first, then by a rather stronger acid boiling, these concretions were only partially dissolved, and there was a disengagement of carbonic acid gas.

The nitric solution, precipitated by ammonia, gave a mixture of phosphate of lime and ammoniaco-magnesian phosphate, sulphuric acid produced phosphoric acid, with lime and magnesia in the form of sulphates.

The liquor from which the two phosphates had been precipitated gave, with oxalic acid, oxalate of lime, representing that which was found in the concretion in the state of subcarbonate.

Finally the liquor separated from the oxalate of lime, by filtration, evaporated to dryness, and the residue calcined left magnesia. I cannot affirm that it was in the state of subcarbonate. I have said that the concretions were not entirely dissolved by the nitric acid. Thinking that the residue might be oxalate of lime or silica, I kept it for three quarters of an hour in water containing carbonate of potassa, then I filtered the alkaline liquor, neutralised with oxalic acid, evaporated to dryness, and the residue, treated with water, left silica perfectly characterised. Oxalic and phosphoric acids were sought for in vain in the liquor. Finally, the residue left undissolved by the carbonate of potassa was silica of a yellow color, still exhaling the odor I have mentioned, and giving ammonia and a charcoal by distillation.

I do not doubt that this silica was combined, or very intimately mixed with the organic matter of which I have spoken; for this matter resisted, at least to a great extent, the action of nitric acid on boiling carbonate of potassa; again, the solution of a considerable proportion of the same silica in the carbonate of potassa shows that, in the kidney, the silica was separated in the state of a matter which had previously been held in solution.

Inorganic Matter	Subcarbonate of lime. Subcarbonate of magnesia. Phosphate of lime, Ammoniaco magnesian phosphate. Silica. Trace of salts of potassa and soda.
Organic Matter	Nitrogenous organic matter. Phosphuretted oil of the blood. Odorous matter arising from the modification of a proximate principle existing in the bile and muscular flesh of the animal.

* *Journal de Pharmacie et de Chimie.*

REPLY TO "A FRIEND OF LIEBIG."

To the Editors of the Chemist.

GENTLEMEN—Not doubting that you are still actuated by the same spirit of fairness which you manifested in your valuable journal some years ago, I am induced to send you a few remarks for insertion, should you deem them worthy of a place.

In reply to "Liebig's Friend," your correspondent of this month, I may remark that he has dealt in a very summary manner with Dr. Brett's observations.

Is not Liebig equally fallible with Brett? Other of Liebig's theories than the one in question are regarded by distinguished men both in this country and on the Continent, as "fallacious and unsubstantiated." Liebig may justly be considered as a scientific would-be despot; he has suggested theories, and seems to expect, or, rather, to order scientific men to adopt them. All Liebig's theories are not to be considered immutable, any more than was Stahl's "Phlogistic Theory;" if Lavoisier had suffered his "Anti-Phlogistic Theory" to be extinguished as your correspondent would fain extinguish Dr. Brett, we might still have been indulging undisturbed in dreamy speculations on "Phlogiston."

Liebig's conduct with regard to Mulder, and the late illustrious Berzelius, has not raised him in the estimation of scientific men.

In 1842 Liebig* himself tells us that he combines in his person so great an extent of knowledge, acquired by innumerable experiments and practical results, that no person could, in future, probably, amass so much (*wie sie sich vielleicht nie in einem individuum wieder vereinigen dürften*); and he undertakes to initiate the human race in the chemical phenomena of living nature. This essay was premature; science did not then possess sufficient positive knowledge to lead to results worthy of reliance.

In reference to this essay, Berzelius says, in his *Annuaire*, 1848, p. 347:—

"I have shewn that in this essay M. Liebig stated improbabilities, and often even some things which could not be so estimated, as demonstrated and inconstestible truths. I therefore put myself in opposition to this unrestrained chemical authority. Considering the height to which M. Liebig thought himself raised, an apology would have been superfluous; any one who had the audacity to dare to make an objection was considered as guilty; and the punishment consisted in entirely censuring his labours on other subjects, of which the school of Giessen endeavoured to nullify the results, in order to diminish the reputation of the author. This is the motive which determined M. Liebig to cause several of my labours to be refuted by his pupils in the laboratory of Giessen.

"The existence of lactic acid in the animal fluids was one of these labors.

"The refutation of it was committed to M. Enderlin, who stated formally that it was on the invitation of M. Liebig that he had undertaken it.

"M. Enderlin* says: 'It is absolutely impossible to admit of the existence of lactic acid in the bodies of these animals (*Carnivora*), *for this acid has not yet been found*, and their food does not contain any substance which can give rise to it.'

"M. Liebig has declared † that the experiments of M. Enderlin proved that no animal fluid contained lactic acid, and that he had himself sought to confirm and corroborate this result by the analysis of fresh and putrified urine, and that he had not succeeded in finding it.

"After M. Liebig was convinced by his own experiments that living bodies contain lactic acid, he did not endeavour to excuse the errors which he and his pupil had committed with respect to the existence of this acid.

"Instead of this, he did all that he could to reduce the labours of his predecessors to mere attempts of insufficient reactions and unfounded hypotheses, in order to appropriate the whole of the discovery to himself. And who could have imagined that this scientific *farce* would have terminated by M. Liebig himself discovering lactic acid in the animal fluids, when I had proved it forty years before him. This mode of acting is quite unprecedented in the annals of science. M. Liebig has endeavoured not to be surpassed in this respect."

The above is not a solitary instance of similar proceedings on the part of the "world-renowned philosopher." Poor human nature!

I am, gentlemen, yours faithfully,

London, Nov. 19. ALPHA.

**Ann. der Chemie und Pharm.* XLI. 373.

** Ann. der Chem. und Pharm.* XLVI., 166.

† *Ann. der Chemie und Pharm.* l. 163.

CITRATE OF IRON AND QUININE OF COMMERCE.

OUR attention has been called by Messrs. Heathfield and Burgess to the valuable preparation sold under the name of Citrate of Iron and Quinine, who also favored us with samples of their preparation, and being informed that the price varied so considerably, as from 2s. to 6s. per ounce, we have deemed it our duty, as it is so essentially necessary that a proper standard strength should be fixed, to examine all the samples

we could procure, and hasten to lay the results before the public.

In the first place, we found the citrate of iron and quinine, as procured from different makers, to vary considerably in external appearance in color, passing through all the shades of green to nearly brown.

We found the greatest possible difference to exist in the proportion of quinine contained by the various samples, commencing with about a fourth, and going down to about a hundredth; indeed, in one specimen it was a mere trace.

Upon further examination of these samples we found that they differed not only in respect to the quantity of quinine which they contained, but also in the state of oxidisement of the iron; some of the samples contain almost all the iron in the state of protoxide, in others it exists as peroxide, and in other samples of mixture of the two in variable proportions.

We consider it as a matter of the greatest possible importance to the public that all medicines should be of a known regulated strength, especially when containing so active a substance as quinine; for if such is not the case how can it be expected that a physician shall be able to prescribe a dose which will cure the patient?

It is our opinion that watching things of this, both for the interest of the public and the honorable-minded manufacturer, who is almost driven out of the markets of this country by sophistications and adulterations, should have formed a portion of the duty of a properly constituted Pharmaceutical Society during the interregnum of pharmacopœical authorship. This was our hope when we urged the druggists of Great Britain to awaken themselves to their own interests.

It a common plan with druggists to test the presence of quinine in the compound under consideration, by adding a few drops of liq. ammoniac, the object being to precipitate the quinine. This method is very imperfect, for, if the solution of the salt is dilute, or if water is subsequently added, the quinine re-dissolves.

The best plan of procedure, to roughly estimate the amount of quinine, is to add a quantity of magnesia; set the mixture aside, in a warm place, shaking occasionally during an hour or two; the supernatant liquor is then poured off, and the quinine dissolved from the excess of magnesia by spirits of wine; this solution being evaporated will give the weight of quinine.

On leaving this subject for the present we beg to assure our readers that we shall watch the citrate of iron and quinine of commerce, and expose the matter more fully unless we find the necessary alteration made; for we consider the man who would practice deceit in the preparation of a medicine as a wretch of the worst possible kind.

TREATMENT OF DISEASED LEECHES.*

BY RICHTER.

As a means of curing leeches affected with articular disease, the author recommends putting the diseased leeches for about twelve hours into a vessel containing 300 to 400 grammes of water, acidulated with five or six drops of sulphuric acid. During this immersion they disgorge much mucous matter. This treatment is to be repeated in three days, and most of the leeches recover.

IV. REVIEWS, NOTICES OF BOOKS, &c.

THE USE OF THE BLOW-PIPE IN THE QUALITATIVE AND QUANTITATIVE EXAMINATION OF MINERALS, ORES, FURNACE PRODUCTS, AND OTHER METALLIC COMBINATIONS. By Professor Plattner, Assay Master of the Royal Freyberg Smelting Works. Edited, with Emendations, by Dr. Sheridan Muspratt, Professor of the Royal College of Chemistry; author of "Outlines of Qualitative Analyses, for the Guidance of Students in Chemistry." Second edition, revised and enlarged. London: Taylor and Walton, and Maberly: 1850, pp. 401.

This is unquestionably the best work on the blow-pipe in the English Language, and science is greatly indebted to Dr. Muspratt for its publication. The original work by Professor Plattner had, for some time, enjoyed a high reputation on the Continent, and in this country amongst those acquainted with the German language. The first English edition has, for several years, held a deservedly high rank in our scientific literature, and this edition is a great improvement on its predecessor.

This work is divided into three sections. Section I. describes the blow-pipe; the combustible material; the blowing, &c., and description of the flame, the supports, ine struments, &c., required in analysis with th

* Buchner's *Repertorium*.

blow-pipe and blow-pipe re-agents. Section II. gives general rules for qualitative, examinations, with and without the assistance of the humied way. Blow-pipe tables, compartment of the alkalies, earths, metallic oxides and acids, metallic sublimates, qualitative examination of minerals, ores, and the products of metallurgic operations, for metallic and non-metallic bodies, and examples of the method of procedure employed in examining different compounds for all their constituents, with the aid of the blow-pipe. Section III. is devoted to quantitative analysis with the blow-pipe, including the silver assay, the gold assay, the copper assay, the lead assay, and the determination of tin.

An Appendix gives a "Systematic Arrangement of the Oxidised Minerals, according to their behaviour before the Blow-pipe"—"Behaviour of the Urinary Calculi before the Blow-pipe"—"Table of Atomic Weights"—"Index to Minerals."

We have thought it advisable to give this epitome of the contents of the volume before us (a plan we frequently adopted with important works) in order that the reader may be in some measure able to judge for himself of its utility.

The study of blow-pipe chemistry has scarcely been pursued so much as its value indicates that it should be; this, perhaps, has been owing to the want of a work like this, which simplifies the subject—nay, more, excites in the mind of him who peruses it a desire to attain proficiency in this very beautiful practice. Dr. Muspratt is a very enthusiastic blowpipist, and from his own very extensive practice has been enabled to enrich his book with so much matter of his own, that it is now appropriately termed "Dr. Muspratt's Plattner on the Blow-pipe."

Professor Liebig has written a kind of testimonial preface, in which he speaks of the execution of the work in very high terms, and Professor Plattner says—"Dr. Sheridan Muspratt has published in English my 'Probirkunst mit dem Lothrohre,' and, really, with such circumspection and profound knowledge of the subject, that I deem it my bounden duty to tender him my heartfelt acknowledgments."

No chemist ought to be without this book.

We have selected the following extract:—

THE BLOWPIPE.

"This instrument was long employed in the arts before any one conceived the idea of applying it to chemical experiments, performed in what is called the dry way. Bergman tells us that the first person who so used it was Andrew Swat, a Swedish metallurgist, and Councillor of the College of Mines, about the year 1733. He left no work on the subject, and it is unknown to what extent he carried the researches which he made with this instrument. Cronstedt, who laid the foundations of Mineralogy, and whose genius so outstripped the age in which he lived, used the blow-pipe to distinguish mineral substances from one another by means of fusible re-agents. From their action such modifications on the subjects to which they applied resulted as might afford some conclusions respecting their composition, and served as a basis for the classification he adopted. In his time the intercourse between men of science was by no means so open as at present; the discoveries of one man were seldom communicated to his fellow labourers, and each pursued his researches with no other help than the experience of the generation which had passed away, and become, in some measure, public property. At such a period Cronstedt carried the use of the blow-pipe to a degree of perfection that can only result from persevering industry: but as slight services in the cause of science were not as yet honoured with general attention, he who was at first afraid to make himself known as the author of that system of Mineralogy which has perpetuated his memory, still less thought of describing in detail this new application of the blow-pipe and the processes he adopted. He only published such results of his experiments as might serve to distinguish minerals from each other, by affording characters peculiar to the different species. Von Engeström, who published an English translation of Cronstedt's system in 1765, annexed to it a treatise on the blow-pipe, in which he particularly noticed the processes of the author, as well as the principal results of their application to the minerals then known. This treatise did not appear till 1770, and was translated and published in Swedish by Retzius in 1773. It attracted the general attention of chemists and mineralogists to the use of this instrument. They, however, derived at first little other advantage from it than as a means of ascertaining the fusibility of bodies, and occasionally their solubility in borax; for it was difficult to form a just estimate of its value, in consequence of the want of that skill in its application which can alone be derived from patience and practice, together with a sufficient knowledge of the phenomena presented by the different substances used as fluxes; whilst the difficulties attending its use were sufficiently evident, and hence, everywhere but in Sweden, the art of the blow-pipe made little progress. As in other sciences, books alone are 'weak masters' to make proficients; but they who

had seen the manipulation of Cronstedt and Von Engeström, learned to work like them, and transmitted their skill to their successors. Bergman went further than Cronstedt; he extended the use of the blowpipe beyond the bounds of mineralogy to the field of inorganic chemistry; and in his hands it became an invaluable instrument for discovering very minute portions of metallic matter in analytical researches. His work 'De Tubo Ferruminatorio' was first published at Vienna, in 1779. Bergman, on account of his health, was assisted in his experiments by Gahn, who particularly applied himself to the use of the blow-pipe in his mineralogical studies in consequence of the readiness with which it affords decisive results. The operations which which he performed under Bergman's inspection, who caused him to examine all the minerals then known, taught him how each conducts itself before the blow-pipe. Assisted by the experience which he thus acquired, he continued to employ the instrument in every kind of chemical and mineralogical inquiry; whence he attained such a degree of skill in its use, that by its means he could detect in anybody the presence of substances which had escaped the most careful analysis conducted in the moist way. Thus when Ekebey asked his opinion respecting the oxide of *Columbium*, then recently discovered, and of which he sent him a small specimen, Gahn immediately found that it contained tin, although that metal does not exceed one per cent. Long before the question was started, whether the ashes of vegetables contain copper, I have seen him many times extract, with the blow-pipe, from a quarter of a sheet of burnt paper, distinct particles of metallic copper. Gahn always travelled with his blow-pipe, and the continued use he made of it led him to several improvements in its application; he examined a great number of re-agents, in order to find new methods of arriving at the knowledge of certain substances, and the whole was imagined and executed with such sagacity and precision, that his results were entitled to the greatest confidence. He most readily and carefully instructed those who were desirous of information on the subject; but he never appears to have thought of publishing an account of his labors, nor has it been done by others. In all the rest of Europe, only one distinguished naturalist has applied himself to the study of the blow-pipe and its uses, and submitted a large number of mineral substances to its action. This was Saussure, justly celebrated for his geognostic researches on the Alps of Switzerland. He, as well as Cronstedt, employed the blow-pipe chiefly in distinguishing minerals; and although he made additions and improvements on the subject, he ranks far behind Gahn in respect to the results which he obtained.

LECTURES ON ELECTRICITY AND GALVANISM IN THEIR PHYSIOLOGICAL AND THERAPEUTICAL RELATIONS. Delivered at the Royal College of Physicians. Revised and extended. By GOLDING BIRD, A.M., M.D., F.R.S., F.L.S., &c. London: Longman and Co., 1849. P.p. 212.

THE physiological and therapeutical relations of galvanism are of the highest interest and importance, and, to their cultivator, a work written in a simple, easy style, and giving a succinct outline of them, was a desideratum.

These lectures were originally published in our excellent contemporary, the *London Medical Gazette*, in 1847, and consequently have been for some time before the scientific public.

Dr. Bird has, with some industry, collected into his five lectures all the information we possess on these branches of electrical science, and, in giving them to the public in their present form, has added some new matter, created since their delivery before the College of Physicians. This he was induced to do, as he informs us, in the preface, by representations made to him by the enterprising publishers, Messrs. Longman and Co., to the effect that the numbers of the *Medical Gazette*, containing the original report of this lecture, had been greatly sought after on that account.

ELECTRO PHYSIOLOGY; BEING A POPULAR ACCOUNT OF THE RECENT RESEARCHES OF MATTEUCCI AND OTHERS, IN THIS DEPARTMENT OF ELECTRICAL SCIENCE, INCLUDING SOME OBSERVATIONS ON THE THERAPEUTIC APPLICATIONS OF ELECTRICITY. By HENRY M. NOAD, Lecturer on Chemistry at St. George's Hospital. Illustrated with wood-cuts. London: G. Knight and Sons. 1849. 67pp.

THIS work is published in a separate form, to suit the convenience of those who have the first edition of Mr. Noad's "Lectures on Electricity." It conveys much interesting and valuable information in a clear comprehensible manner. Commencing with a sketch of the history of Electro-Physiology, it gives an account of all the most recent discoveries and theories in this department of electrical science. It is certainly deserving of a place in the scientific library.

As an extract we give the following description of

THE AUTHOR'S ARRANGEMENT OF THE MEDICO-ELECTRO-DYNAMIC COIL MACHINE,

which is constructed with the object of regulating to the greatest nicety, not only the strength, but also the frequency in the direction of the shocks. It consists of a coil of about one hundred yards of covered wire wound on a hollow core of wood, in the axis of which a bundle of iron wires may be inserted, so as to combine the effects of *magneto* with those of *volta* electric induction. The coil is covered with black leather or velvet, and is fixed by screws to the base board of a platform, on the upper table of which stands a piece of clock work apparatus, destined to give revolving motion to a brass disc, provided with platinum teeth or cogs. This clock-work is in metallic connection with one of the poles of the battery, which consists of two cells on Mr. Smee's plan; the other pole of the battery is metallically united through the coil with a small brass stage, to which is adapted a piece of steel spring, tipped with platinum, and which is so arranged as to come into contact with each tooth or cog of the disc during its rotation; by means of a screw, the degree of force with which it presses on the cogs is readily adjusted.

The manner in which this machine acts will be clearly understood, by reference to the general principles of *volta-inductric action*. When the battery circuit is completed through the coil, and contact established between one of the cogs of the disc and the steel spring, the current traverses the coil, and no sensible spark, or only a very feeble one, is perceived; but the moment the spring leaves the cog, and on the consequent return of the wire to its natural state, a *reflex wave* of electricity, moving in a *contrary direction* to that of the battery current, is generated, and a bright spark is produced. Now, this bright spark is not occasioned by any direct action of the battery, as Faraday has shown,* but by a force exerted in the wire of communication—that is, in the coil; and if two wires, connected respectively with either extremity of the coil, be brought almost into contact, at the very moment that contact with the battery is broken, the spark will appear at the interval between them, while that at the disc will be very feeble; so, also, if a fine platinum wire be interposed between the two cross wires, it will remain unaffected as long as the spring and the disc are in contact; but the moment the former leaves one of the teeth of the latter, the platinum wire either fuses or becomes red-hot.

The spark which passes between the cross wires is one of great intensity; and if the body be interposed, a shock, more or less violent, according to the size of the coil, is experienced; if a bundle of iron wires be thrust into the axis of the coil, it becomes insupportable. That this *induced* current does really move in a direction *contrary* to that of the battery current, may be proved both by the galvanometer and by chemical decomposition. If a galvanometer of no great delicacy be interposed between the cross wires, it will show a current in the direction of the battery current, as long as the spring remains in contact with the disc, a portion of the electricity excited by the battery passing through the wire of the galvanometer; but if the needle of the instrument be forced back by pins applied upon opposite sides of its two extremities, so as to retain it in its natural position, when uninfluenced by a current; and if, then, the spring be caused to leave the tooth of the wheel with which it is in contact, the needle will immediately be strongly deflected in an opposite direction, showing, evidently, that the reduced current follows a course *contrary* to that of the battery. Again, if two platinum discs be covered with bibulous paper, moistened with iodide of potassium, and attached respectively to the ends of the two cross wires, a feeble evolution of iodine is *sometimes*, though rarely, obtained during the maintenance of contact; but the moment the spring leaves the cog the salt is decomposed in such a manner as to show the passage of a current in the reverse direction to that of the battery.

From these facts, it will be seen at once that we have in this arrangement of the coil, a ready method of administering to a patient, either *direct* or *inverse* shocks at pleasure. In the front of the lower platform, and between the two supports of the upper stage, is a small water-regulator. This is interposed in the circuit of the coil, and by raising or depressing the upper wire, which is done in the most gradual manner by making it a screw, the intensity of the shocks may be modified to any degree; and such perfect command does this simple arrangement give us over the power of the induced shock, that we are enabled, by means of it, to apply this form of electricity to so delicate an organ as the eye, or to administer shocks sufficiently severe to bring a stout man to his knees. The clock-work is so contrived as to give the disc one re-

* See his *Experimental Researches*, par. 1,078, *et seq.*

volution per minute. Several of these discs are provided, each with a different number of cogs, and we have thus a convenient method of regulating the frequency of the shocks.

GUIDE TO THE ALKALIMETRICAL CHEST; OR, PRACTICAL INSTRUCTIONS FOR THE DETERMINATION OF THE COMMERCIAL VALUE OF ALKALIES AND OF ACIDS. By A. Normandy. Illustrated with Wood Cuts. London: G. Knight and Sons. 1849.

This is a guide to an alkalimetrical chest contrived by Messrs. Knight, which contains Mr. Normandy's alkalimetre, and other apparatus and chemicals necessary for testing alkalies by means of it.

The "Guide" describes all the alkalimeters and alkalimetrical processes in use; and, for those who use these instruments for testing the commercial value of soda ash, it will be useful.

PRACTICAL OBSERVATIONS ON GALVANISM, ELECTRICITY, AND ELECTRO-MAGNETISM, AS EMPLOYED IN THE CURE OF DISEASE: WITH REMARKS ON THE ADVANTAGES OF THEIR APPLICATION THROUGH THE MEDIUM OF BATHS: CONTAINING FULL DIRECTIONS RELATIVE TO THE CHOICE AND MANAGEMENT OF APPARATUS. By John Palmer Tylee. Bath: Clark.

The object of this work is to prove the superiority of the plan of administering electricity by means of baths, as proposed by Mr. Tylee, and he gives the following "especial reasons" for preferring it:—"First, because it differs from the usual mode, in not producing violent and oft-repeated shocks; in the water its flow is continuous, and is a current rather than a shock. While the dry electro-galvanism influences more particularly the courses of the particular nerves and their primary branches, the water medium enables us to apply this powerful agent to the more sentient extremities, so that the minutest fibres of a muscle, or set of muscles, are brought into a pleasurable action rather than into a spasmodic one. By means of a portable disc we are enabled to produce this effect at will, to regulate the intensity of the current, and, by its modification, to apply it to any distinct set of muscles, without implicating those which are unaffected by disease, which is not the case with dry electro-galvanism; I conceive its application to be most useful in the various cases in which the lumbar muscles, or those of an entire limb, are deficient in nervous powers or energy. In eye cases this method is more likely to be successful than the vibrating shock of the usual method, for the application of which I have invented an eye bath, so that the intensity can be regulated with the nicety required for so delicate an organ. It must be remembered that natural and artificial warm baths are means of cure in almost every case in which the application of electro-galvanism is required, so that, by its combination with the warm bath, we are using two agents combined in a useful and agreeable manner." He gives some cases in which he has found advantage from this mode of applying galvanism. We recommend the subject to the attention of our readers.

Announcement.—We are glad to understand that Dr. Muspratt is about to publish a second edition of his "Outlines of Qualitative Analysis." The first edition was so well received that he has determined on greatly extending it. It will embrace all the most important blow-pipe re-actions in a tabular form.

TO CORRESPONDENTS.

We have to acknowledge the receipt of samples of patent gelatine from Mr. T. C. Swinborne, which shall have our early consideration.

"A Constant Reader" must send us a little more information, otherwise we cannot help him.

"T. W."—If you have proceeded exactly as you say, galvanic action must have established, but it would be very weak. Did you use the galvanic meter? Write again.

"Omega."—Try pure animal charcoal. However we fear that the perfume will be destroyed.

"J. R." (Bristol).—Dissolve nitrate of potassa in strong sulphuric acid applying heat. 2. Add common salt.

"A Friend."—Oxalate of ammonia.

"Chemicus."—Brande's "Manual" will help you.

Answered by Post.—"C. H. Thew."—"A. W."

"J. B. N." (Brighton) will be answered in our next number.

Notice.—*All Communications and Books for Review must be addressed* "To the Publisher of The Chemist, 17, Surrey-street, Strand, London." *Communications must be pre-paid, and sent before the* 15*th of each month. Books for Review before the* 10*th,*

THE CHEMIST.

[NEW SERIES.]

I. CHEMISTRY.

GENERAL CONSIDERATIONS ON THE ELECTRO-CHEMICAL THEORY.*

BY M. BECQUEREL.

THIRD EXPERIMENT.—Instead of operating as above, a vessel was divided into two compartments, by means of a membrane, and both were filled with distilled water. Into one was put a plate of copper, and into the other a plate of platinum, the two plates being in communication with a galvanometer. The magnetic needle was deflected a few degrees, by virtue of a current going from the copper to the platinum, through the liquid, which current was due to the very feeble action of the water on the copper. When chlorine was made to act on the copper plate, the magnetic needle returned to zero, and sometimes went beyond that. The copper was then very powerfully attacked.

The liquids were removed and replaced by water; and then the plates were again immersed therein, after having washed them in distilled water, and this time chlorine was made to act on the platinum plate. The magnetic needle was then deflected in the opposite direction, by virtue of an electro-dynamic force, whose intensity was five times as great. With a pair of iron or tin and platinum, the results were still the same. The presence of chlorine in the water in which the platinum was, then produced an energetic current in an opposite direction. With bromine and iodine it was also the same. If we confine ourselves to taking into consideration the chemical action of the water, or of the chlorated water, on the copper, we draw, with Matteucci, the following conclusions:—

1. The chemical action which takes place in the combination of metals with the metalloids, disengages no electricity.

2. Electricity is disengaged only when the chemical action takes place between a metal and one of the elements of a combination in the liquid state, which is decomposed by this action.

But if we analyse this phenomenon completely, substituting for the plates of copper and platinum two plates of platinum, we find that these conclusions are inadmissible. Indeed:—

FOURTH EXPERIMENT.—Let A and B represent two porcelain capsules filled with a solution of nitrate of potassa, communicating, by means of a bent glass tube, containing the same solution. Into A plunge a plate of amalgamated zinc, and into B a platinum plate, communicating with each other by means of a multiplier. The following are the effects observed:—

Deviation of the magnetic needle, 35°, by virtue of a current going from the zinc to the platinum, through the solution.

The addition in A of an iodised solution of nitrate of potassa likewise gives a deviation of 35°.

On the other hand, on pouring the iodised solution into B, the deviation was 50°.

On putting the iodised solution into both, the deviation was 60°.

When we operate with two plates of platinum, we have two currents of inverted direction, according as the iodised solution is put into A or B. Consequently it was clearly demonstrated that the contact of water with iodised water gives rise to a current which passes from the latter to the former.

This experiment was repeated several times, and the results were always the same.

It is, therefore, evident that, in Matteucci's experiment, two currents are produced, of which account must be taken in

* *Annales de Chimie et de Physique*, 3me. Série; tome xxvii. Sept., 1849.

the interpretation of the effects produced. One is due to the reaction of the two liquids on each other, and the other to that of the copper on the liquid with which it is in contact.

Fifth Experiment.—In the following experiment, I wished to show, contrary to Matteucci's deduction, that the current increases in intensity when the amalgamated zinc and copper pair is immersed in an iodised or chlorated solution, *ceteris paribus*.

Let two pairs, AB and A′ B′, be arranged as in the preceding experiment, and in such mutual dependence, that the copper C of one be put in communication with the copper C′ of the other, and the two zincs, ZZ′, with the two extremities of the wire of the multiplier. The capsules AB and A′ B′, as well as the communicating tubes, are filled with a solution of nitrate of potassa. These two currents being equal, and passing in inverse direction, are destroyed, and the magnetic needle is not deflected.

Some solution of nitrate of potassa, containing chlorine, was poured into A′ and B′; the current arising from this overcame the current of the other; whence it follows that the reaction of the chlorated solution on amalgamated zinc increased the intensity of the current.

Deviation of the magnetic needle, when only one of the pairs was in action, 75°.

When the two couples acted together, deviation, 0; deviation, on pouring a small quantity of chlorated solution into A′ and B′, 81°.

It is evident, consequently, that the zinc and copper pair, acting with the chlorated solution, gives, the conductibility being equal, a much more energetic current than with the simple solution, which shows that the chlorated solution, attacking the copper more powerfully than the simple solution, produces at the same time a more energetic current.

Nothing, then, is more simple than to explain, in the electro-chemical theory, the facts observed by Matteucci, without involving the necessity of modifying the bases on which it rests. Indeed, in the third experiment, in which the copper and platinum were placed in distilled water, we have only a feeble current due to the oxidation of the copper, and going from that metal to the water. By bringing chlorine in contact with the copper, the latter is more powerfully attacked, doubtless, than when it was in water only; but there is at the same time manifested another current in an opposite direction to the first, due to the reaction of the chlorated solution on that which is not so; it is not, therefore, surprising that the magnetic needle retrogrades, returns to zero, and sometimes even goes beyond.

On putting, on the contrary, the chlorated solution in contact with the platinum plate, the two currents travelling in the same direction, their action on the magnetic needle is added, and the deviation then becomes more considerable.

We cannot, therefore, admit the conclusion at which M. Matteucci has arrived, namely, that there is a disengagement of electricity in a chemical action only when this action occurs between a metal and one of the elements of the solution in which it is immersed. But, if it were always thus, how would the considerable disengagement of electricity, which takes place in the reaction of an acid solution on an alkaline solution, be explained? In this reaction there is only a simple combination, hence we cannot adduce a secondary action as a cause of electrical effects.

The details into which I am now going to enter, relative to the electrical effects produced in combustion and in certain decompositions by aid of heat, corroborate the principles which I have just explained, and which are only the expression of the facts, in the interpretation of which I make all the causes which contribute to their production concur.

The electrical effects manifested in combustion have been observed for more than twenty years, and are analogous to those which take place in chemical actions in general. Matteucci thought it right to repeat the experiments which had already been made, with the view of verifying the effects previously observed. He examined successively what takes place in the combustion of hydrogen and carbon, in the oxidation of iron and zinc, in the combination of copper, tin, antimony, and zinc with chlorine; finally, in the decomposition by heat, of the oxides of gold, silver, &c. The results at which he arrived led him, likewise, to admit that the combination of a simple body with a simple body never disengages electricity. This conclusion is not admissible in the cases which I have just mentioned.

Davy had already advanced that there was no electricity disengaged in the combustion of charcoal, iron, &c., nor in the decomposition by heat of the oxides of gold and silver. This is true, in operating as he did, and as often as one of the elements, entering into combination or leaving it, is a non-conductor of electricity—as very dry oxygen and hydrogen. Let us analyse the phenomena.

A jet of hydrogen gas, issuing from a glass tube, and enflamed, negatively electrises a small platinum spiral placed in the centre, where the flame is not yet in contact with the air, and positively, when it only surrounds

the flame. These effects have hitherto been attributed to the combustion of hydrogen. This gas, in combining with the oxygen of the air, forms steam, which carries with it the positive electricity disengaged by the oxygen, whilst the hydrogen furnishes, by means of the first portions of water formed, the negative electricity resulting from the combination.

Matteucci sees in this phenomenon only effects similar to those observed in Grove's gas battery, each element of which acts by virtue of electrical effects produced in the reaction on water of the oxygen and hydrogen adhering to two platinum plates. In the first case, these two gases are separated by steam; in the second, by water in the liquid state. This explanation may be admitted; but the facts may be perfectly interpreted on the general principles which govern the electrical phenomena produced in chemical actions, and with so much more reason, as I shall demonstrate further on, as bodies which are bad conductors of electricity become good conductors when they are in a state of fine division in the presence of water.

Matteucci found that in operating with spirals of iron, copper, brass, or any other metal than platinum, there was no sign of electricity, or only traces of negative electricity, by heating sufficiently, and that, to obtain more marked effects, it was necessary to place near the spiral, at the distance of two or three centimetres, another metallic spiral in communication with the earth. Here, the effect is complex, since there are two chemical actions—combustion of the hydrogen and oxidation of the metal. In the combustion the oxygen is positive, and the hydrogen negative; in the oxidation, the metal is negative, and the oxygen still positive; now, if the spiral be placed in the external flame, it might be useless, unless we removed, with another spiral placed at a short distance from the flame, from the oxygen or the air, its excess of a positive electricity, which incessantly tends to neutralise the negative electricity of the metal, and which results from the oxidation.

In the combustion of charcoal, we ordinarily operate as follows:—Prepare a cylinder of charcoal of sufficiently large diameter to be placed vertically at a few centimetres below the inferior plate of the condenser. After having made the charcoal communicate with the earth, it is lighted at its upper end; a column of carbonic acid gas immediately arises, and communicates to the inferior plate an excess of positive electricity. If it be desired to collect the negative electricity of the charcoal, it is placed, on its base, on the superior plate, and the fire is sustained by a slight current of air, in order more promptly to remove the carbonic acid gas, charged with positive electricity. Such is the mode of experimenting pointed out by M. Pouillet.

Matteucci, who repeated and varied this experiment, found no sign of electricity in subjecting, as Davy had done, the small cylinder of charcoal to a platinum wire in communication with one of the plates of the condenser, and immersing the lighted charcoal in a vessel filled with oxygen gas. This negative result might have been foreseen: when oxygen—a bad conductor—combines with any body whatever, out of the presence of water, it is impossible to collect electricity with a condenser; and even when it is disengaged, the carbonic acid gas remaining constantly in contact with the charcoal, there is an immediate recomposition of the two electricities disengaged. It is to avoid this recomposition that, in M. Pouillet's experiments, air is continually blown on the charcoal, to keep up the fire and to drive out the carbonic acid.

Matteucci explains the effects produced in Pouillet's experiment in the following manner:—in ordinary charcoal there is always hydrogen which burns with the charcoal, whence result water and carbonic acid gas; the charcoal, in burning, decomposes this water. According to this view, the charcoal is in the same position as an iron crucible or potassium on which water is thrown. This explanation is justified, in his opinion, by the absence of hydrogen when charcoal is burned in pure oxygen. Having already explained why there is no disengagement of electricity in this case, I need not here repeat it.

It cannot, then, be admitted that there never is a sign of electric tension nor production of a current in the combination of two heterogeneous elementary molecules, nor in the separation of those molecules, when they are combined; nor that these signs appear only when chemical action takes place between an elementary molecule and a compound of two other heterogeneous molecules. In thus regarding the subject, the electrical phenomena manifested in chemical action, which are subject to simple laws that cannot be mistaken, are singularly restrained.

It has long been acknowledged that there never are electrical effects in the contact of two bodies which act chemically on one another, or one of which is attacked by an external agent, when these two bodies, or one of them only, is a bad conductor, those cases always excepted, in which one of these bodies is in the state of vapor, and in presence of water or steam.

Experiment has proved, on the other hand,

that the elementary parts of all bodies possess the conducting faculty, since, in electro-chemical decompositions, the gases, sulphur, carbon, iodine, &c., bad conductors, are deposited, some on the positive pole, others on the negative pole; which deposit can be effected only inasmuch as their elementary molecules, in presence of water, are conductors of electricity.

The molecular state, moreover, exerts such an influence on the conducting power, that there exist bodies, such as sulphuret of silver, water, &c., which, not being conductors in the solid state, become so in the liquid state. Conducting bodies, in general, gradually lose this power on the temperature being raised, and when they are in the state of vapor they permit the passage of the electricity only when the current possesses great intensity.

It is possible, however, to observe the effects which take place in the contact of liquids, and bad conducting bodies, taking the latter in a state of minute division, and when we remember that a bad conducting gas, such as oxygen, nitrogen, or hydrogen, adhering to a plate of gold or platinum in communication with one end of the wire of a multiplier, gives electrodynamic effects when it is dipped into distilled water, and when the circuit is closed with another similar plate fixed to the other end of the wire, but previously heated to redness, in order to drive off the gases which might adhere to its surface. These effects are due to the reaction of the gas on the water. With oxygen, the current goes from the water to the gas; with hydrogen it passes in the opposite direction. This current can arise only from the action of the gas on the water—the sole cause that can be adduced.

If, instead of making the gases adhere to these plates, excessively fine powders of non-conducting substances be deposited on them, analogous effects are obtained, whatever be the nature of those substances; taking, however, proper precautions to guard against the complex effects resulting from the presence of gases on the powders, which precautions consist in keeping these powders constantly in water, or in the solution operated with, after having boiled it.

These are the results obtained:—

When two platinum plates, whose surfaces are freed from foreign matters, and which are connected with a multiplier, are plunged simultaneously into a capsule filled with distilled water, the equilibrium of the forces could not be disturbed, since everything is alike; but if one of the plates be removed from the water and strongly heated in the flame of a spirit-lamp, then replaced, after it has perfectly cooled in the water, there always results a very feeble electric current, which causes the magnetic needle to deflect by first impulse 5, 10, or 15 degrees, according to the delicacy of the apparatus, and in a direction showing that the newly-immersed plate takes positive electricity.

Two causes may be adduced to explain the production of this current:—1. The capillary action exerted in the contact of solids and liquids. 2. The reaction on water of the small layer of air which is deposited on the surface of the plate during the cooling. These two actions being simultaneous, it is difficult to determine the part played by each of them, when they last only for an instant; but when the current continues we are certain that it is due to the action on the water of the small layer of air adhering to the platinum plate. It is then easy to take account of it in the experiments, since we can measure its effects and deduct them from those which are due to the presence of the powders previously deposited.

Although we have no accurate means of measuring the effects in question, the differences observed suffice to show the causes which contribute to the production of the phenomena. The following experiments will leave no doubt in this respect.

First Experiment. — Two platinum plates, connected with a multiplier by a long wire of great sensitiveness, steeped in distilled water, gave no current. One of them was removed, and rubbed between two pieces of sulphur, previously washed with distilled water, avoiding contact with the fingers—after which it was replaced in the distilled water; the magnetic needle was moved from five to ten degrees. The direction of the current indicated that the plate on which the particles of sulphur were deposited took from the liquid negative electricity. The current travelled, therefore, in the opposite direction to that which would have been produced had the plate been covered with a layer of air.

By rubbing the plate, removed and washed in a capsule containing distilled water, between two crystals of Iceland spar, previously washed, a current was obtained whose direction indicated that the carbonate of lime had taken from the water negative electricity, an effect due, doubtless, to the reaction of the carbonate of lime on the small quantity of carbonic acid contained in the water; silica, with regard to water, is negative, &c.

It is more advantageous to operate by substituting for distilled water a saturated solution of nitrate of potassa, in which the two plates of platinum or gold are constantly

steeped, in order to prevent the gases in the air from adhering to them. When it is desired to deposit powders on one of these plates it is removed from the solution and placed in the same solution with which an agate mortar has been filled; then powders are thrown in which are strongly rubbed on the surface with the pestle, in order to cause as perfect an adherence as possible.

The following are the results obtained by submitting to experiment a certain number of substances reduced to powder.

The solution is positive with the following powders—

Minium
Protoxide of copper
Protoxide of tin
Oxide of zinc
Silica
Red sulphuret of mercury
Sulphuret of silver
Alumina

The solution is negative with the following powders—

Tritoxide of lead (very powerful)
Peroxide of iron (very powerful)
Oxide of silver
Deutoxide of tin
Black deutoxide of copper.

It is evident, from these results, that, in general, the oxides, which contain most oxygen, take an excess of positive electricity in their contact with the water of a saline solution of neutral salt, and that the protoxides, silica, alumina, &c., take negative electricity.

It may now be asked—what molecular action takes place in contact with water, and the minute particles of bad conductors? It is to be presumed that the hydratation, although taking place in an exceedingly feeble degree, must exert an influence on the production of the phenomena, since it results from my experiments and those of Faraday, as I have already said, that the oxidation of a quantity of hydrogen capable of giving 1 milligramme of water, disengages sufficient electricity to charge twenty thousand times an armed surface of 1 metre superficies to such a degree that the sparks resulting from the discharge are as much as 1 centimetre in length.

Now, as the tritoxides of lead and iron to be hydrated lose oxygen, they must disengage positive electricity, whilst the electrical effect, in the decomposition, is of contrary direction to that which is produced in the combination; it is, therefore, not surprising that the experiment gave this result.

With regard to the powdered quartz, can it also be said that there is a commencement of hydratation? The question is of the same order, and the reply must be the same. To conclude—there is no reason, even of the least value, for modifying the laws which govern the electrical phenomena produced in chemical and molecular actions, which serve as the bases of the electro-chemical theory, as I have explained it in my "Traité Expérimental de l'Electricité et du Magnetisme," and, more recently, in my "Traité de Physique Appliquée à l'Histoire Naturelle," which laws I have repeated in the course of this memoir. No direct experiment authorises us in admitting that atoms have an electrical state pre-existent to the chemical action, and still less that this electrical state consists in a polarity, by virtue of which combinations are effected, and which is such that the two poles have not the same intensity. If we do not wish to heap hypothesis on hypothesis to endeavor to demonstrate the identity of electrical forces and affinities, and if we keep to experiment, we must confine ourselves to saying that at the instant when affinities exert their action, there is a disengagement of electricity which seems to indicate that the simple or compound atoms, at the moment they enter into combination, seem to be constituted in two different electrical states, which continue as long as the combination endures, and disappear as soon as it ceases to exist.

ON THE DECOMPOSITION OF ORGANIC SUBSTANCES BY ELECTRICITY.*

BY M. KOLBE.

When a solution of an organic substance in water is decomposed by means of a battery, the oxygen resulting from the decomposition of the water may be conveyed in the nascent state to the organic matter, and cause it to undergo a more or less advanced degree of oxidation. The water which is decomposed by the battery constitutes, consequently, an energetic oxidising agent, which chemists may turn to account in many cases, and whose action may be regulated at will by varying the intensity of the galvanic current. M. Kolbe has studied the action which oxygen liberated at the positive pole of the battery exerts on the series of fatty acids $C^n H^n O^4$. He selected these acids with the intention of verifying a theoretical idea he had formerly expressed concerning their constitution. He admits that these are conjugate combinations all containing oxalic acid intimately united with those hydrocarburetted radicals, of which a celebrated theory admits the existence in the alcohols and ethers. The constitution of the fatty acids is represented, according to M. Kolbe, by the general sym-

* *Annalen der Chemie und Pharmacie.*

bol $C^n H^{n+1} C^2 O^3 HO$, which is developed in the following table :—

Formic acid..	$C^2 H^2 O^4 =$	H	$C^2 O^3$, HO
Acetic acid..	$C^4 H^4 O^4 =$	$C^2 H^3$,	$C^2 O^3$, HO
Metacetic acid	$C^6 H^6 O^4 =$	$C^4 H^5$,	$C^2 O^3$, HO
Butyric acid .	$C^8 H^8 O^4 =$	$C^6 H^7$,	$C^2 O^3$, HO
Valeric acid .	$C^{10} H^{10} O^4 =$	$C^8 H^9$,	$C^2 O^3$, HO

This hypothesis finds, according to the author, a valuable support in the decomposition which the fatty acids undergo under the influence of the battery. Valeric acid, for example, is converted, by means of a galvanic current, into hydrogen, carbonic acid, and valyle, for it is under this name that M. Kolbe designates the hydrocarbon $C^8 H^9$. Such is, at least, according to the author, the principal reaction produced, and which may be expressed by the following equation—

$$\underbrace{C^{10} H^{10} O^4}_{\text{Valeric acid.}} = H + C^2 O^4 + \underbrace{C^8 H^9}_{\text{Valyle.}}$$

The decomposition of valeric acid by means of a battery is not, however, so simple as the foregoing formula indicates. Secondary actions are produced, which M. Kolbe has studied. He employed for the decomposition in question a saturated solution of valerianate of potassa. This salt is introduced into a test-glass, in which are two cylindrical plates, one of copper, the other of platinum. They are isolated from each other, and form, the first the negative, and the second the positive electrode of a Bunsen's battery of four elements. The test-glass into which the solution to be decomposed has been poured, is stopped with a cork fitted with a disengagement tube to conduct the gas into the different condensers and finally into a mercurial trough.

The products which M. Kolbe collected by employing this arrangement are a liquid which formed on the surface of the solution contained in the test-glass, and a gaseous mixture, formed of carbonic acid, quadricarburetted hydrogen, and free hydrogen.

The oily liquid which constitutes one of the principal products of this reaction was not pure valyle. It contained an oxygenous product from which the author freed it by boiling it with an alcoholic solution of potassa. The valyle was not attacked, and the oxygenous product,* decomposed by the potassa, gave rise to a certain quantity of valerate of potassa. The cooled liquor was mixed with a large quantity of water, which caused the separation of the hydrocarbon $C^8 H^9$. After having agitated it several times with water, it was dried over chloride of calcium and rectified.

It is a colorless liquid of a very agreeable etherial odor, and of a taste at first insipid and then caustic. It boils at 226° F., its density at 64° F is 0·694, that of its vapor was found by experiment to be = 4·053 ; calculation requires 3·9387.

Valyle is scarcely attacked by concentrated nitric acid, nor even by a mixture of bichromate of potassa, and sulphuric acid. A mixture of fuming nitric acid and sulphuric acid converts it into butyric acid, and, perhaps, according to M. Kolbe, into nitrobutyric acid—

$$C^8 \left\{ \begin{matrix} H^7 \\ H^2 \end{matrix} O^4 \right\} O^4$$

Chlorine and bromine attack it under the influence of light, forming products of substitution.

The gases disengaged during the decomposition of valerate of potassa by the battery consist, as we have already said, of a mixture of carbonic acid, quadricarburetted hydrogen and free hydrogen. The carbonic acid remains partly combined with the potassa, and the portion which is disengaged may easily be retained by means of Liebig's apparatus. With regard to the mixture of hydrogen and quadricarburet, it may be analysed by introducing pieces of coke impregnated with fuming sulphuric acid, which absorbs the quadricarburet. After having found that the mixture in question contained 27·8 per cent. of quadricarburet, M. Kolbe easily completed his analysis by eudiometrical experiments,

* M. Kolbe thinks that this oxygenous product constitutes the valerate of oxide of valyle, $C^{10} H^9 O^3$, $C^8 H^9 O$. This compound ether is converted by potassa into valeric acid and hydrate of oxide of valyle (butyric alcohol), which he did not find in the products of the reaction. He attributes to it so great a solubility in water that its separation from the alcoholic liquid in which it is formed is very difficult, and even impossible, in operating on a small scale. The discovery of butyric alcohol would be, in our opinion, too important a fact for the experiment of the decomposition of valerate of potassa by the battery not to merit repetition on a large scale. We may here remark that the denomination of valyle applied to a substance which evidently belongs to the butyric series, and which is converted into butyric acid by oxidation, does not appear happily chosen. A simple remark will suffice to show the inconvenience of this nomenclature. In applying it to the hypothetical radicals $C^4 H^5$, and $C^8 H^9$, whose existence in metacetic and acetic acids M. Kolbe admits, they must be called metacetyle and acetyle. Now the first is confounded with ethyle, and the second with methyle. We think that it would be better to designate the combination $C^8 H^9$ by the name of butyryle, as it is agreed to call the hydrocarbon $C^8 H^8$ by the name of butyrene.—A. W.

and by the determination of the density of the gaseous mixture.

It is known that bicarburetted hydrogen $C^2 H^2$ combines directly with chlorine, forming the Dutch liquor $C^2 H^2$, Cl or $C^4 H^4 Cl^2$. M. Kolbe obtained a similar combination with the quadricarburet. By passing into a flask in a dark place, chlorine and this mixture of hydrogen and quadricarburetted hydrogen, an oily liquid analogous to Dutch liquor was condensed.

Purified in a suitable manner, this product constitutes a limpid colorless liquid, of a sweetish odor resembling that of chloride of elayle (Dutch liquor). It readily dissolves in alcohol and ether; and boils at 253° F. In the flame of a spirit lamp it burns, giving a black smoke and forming vapors of hydrochloric acid. Its density is about 1·112 at 64° F. The density of its vapor, determined by experiment, is 4·426; calculation leads to the cypher 4·3837. The composition of this chlorated product may be expressed by the formula $C^6 H^3 Cl^2$.

It is easy to account for the formation of quadricarburetted hydrogen in the decomposition of valerate of potassa by the battery. As the valyle and oxygen arising from the decomposition of the water go to the same pole, it is evident that these two bodies in reacting on each other give rise, by virtue of a secondary action, to water and quadricarburetted hydrogen gas (ditetryle of Berzelius).

$$C^5 H^9 + O = 2\ C^4\ H^4 + HO.$$

Valyle. Quadricarburetted Hydrogen.

Decomposition of Acetate of Potassa by the Battery.—On substituting in the foregoing experiment acetate of potassa for the valerate, the author ascertained that, in the decomposition of this salt by the battery, only gaseous products were disengaged. As might be expected, being guided by analogy, at the positive pole was obtained a disengagement of methyle gas $C^2\ H^3$ and carbonic acid gas, whilst hydrogen was disengaged at the negative pole. To these products must be added a small quantity of oxygen resulting from the decomposition of water, and the oxide of methyle evidently formed by the direct oxidation of the methyle. M. Kolbe succeeded in determining the nature and proportions of these different gases by means of careful and faithful analyses. The following equation accounts for the principal reaction effected in the decomposition in question:—

$$C^4 H^4 O^4 = H + C^2 H^3 + 2\ CO^2.$$

In conclusion, we may add that M. Kolbe had previously obtained methyle gas $C^2 H^3$ by submitting hydrocyanic ether to the action of potassium.

CHEMICAL INVESTIGATIONS CONCERNING THE BARK OF CAIL-CEDRA.*

BY EUGENE CAVENTOU.

After the discovery of sulphate of quinine, endeavors were made to find an analogous medicine in some indigenous vegetable capable of supplying the place of this valuable substance; but all these efforts were fruitless; sulphate of quinine is still the febrifuge *par excellence.*

However, good quinquinas are becoming scarce, and very dear; the working of them, for many years, in their native forests, has been an actual devastation, and it is to be feared that these valuable barks will ultimately fail altogether, or, at any rate, become so exorbitant in price that the sulphate of quinine will be within the reach of only the richer classes of society.

The most powerful febrifuge with which we are at present acquainted is found in a country where fevers possess great intensity; it is a dispensation of Providence, the intention of which cannot be mistaken. But South America and the Carribee Islands are not the only countries in which the fever makes numerous victims; in Africa, and the Indies, this fearful disease reigns in full force. There must, therefore, exist in these countries, trees known to the natives, and which cure them when they are attacked.

It was with this persuasion that the author wrote to M. Servant, Director of *Ponts et Chaussées* at Senegal, asking him if there did not exist in that colony a very powerful febrifuge in use among the negroes.

M. Servant sent him the bark of cail-cedra, as being the febrifuge most highly esteemed by the native population, who generally prefer the cheap decoction which they make of this bark to the sulphate of quinine offered to them by the Europeans; and the fierceness with which the fever rages at Senegal is well known.

The bark cail-cedra is furnished by the *Khaya Senegalensis* (*Swietenia Senegalensis*).

This tree, which is one of the largest and most beautiful that ornament the banks of the Gambia and the lowlands of the peninsula of Cape Verd, belongs to the family of Meliaceæ.

The febrifuge properties of this bark have been known for a long time: thus, M. Guibourt, in his *Materia Medica*, page 607, says that in India, where it also exists, "The bitter bark of *Swietenia febrifuga* is employed as a febrifuge." In the *Journal*

* *Journal de Pharmacie*, Nov., 1849.

de Pharmacie, vol. ix., p. 522, several preparations made with this bark are pointed out as curing dysentery and fever. In vol. xi., p. 518, of the same journal the bark of *Cedrela febrifuga* is called by M. Nec, of Esinbeck, the quinquina of the West Indies. Finally, in the *Dictionnaire de Matière Médicale*, by MM. Mérat and Delens, may be found several articles relating to this tree, and, among others, one (vol. v., p. 652), in which it is called quinquina of Senegal.

The bark of cail-cedra is about 0m 015 in thickness; it is greyish outside, cracked, and very hard; under the epidermis it is of a yellow color, which diminishes towards the inside; it develops, in mastication, a very perceptible bitterness; its fracture is clear, of a very close grain, and it presents, in the direction of the length of the tree, white lines, which become more and more close and numerous towards the interior of the bark.

It is this bark which the negroes take in infusion or in decoction for curing the fever; when they are attacked, they also wash their shoulders, head, and arms with it.

M. Caventou's first idea was that an alkaline principle might exist in it, which would represent at once the bitter principle and the antiperiodic properties contained in the bark of *Swietenia Senegalensis*.

An extract was prepared with the bark, by means of alcohol. This extract was treated with boiling water; the greater part of the extract was redissolved, and there remained only a little coloring matter and fatty matter. Indeed, the residue treated by ether denoted the presence of a green fatty matter, which, in all probability, is analogous to that of the quinquinas.

When the boiling aqueous solution was cooled, it was filtered; its action on blue litmus was slightly acid.

It was afterwards treated with caustic magnesia; it was boiled for 20 or 25 minutes; the magnesia formed an insoluble lake with the red coloring matter, and the very bitter supernatant liquid acquired a characteristic yellow color. The precipitate, washed and dried in an oven, was treated twice with boiling alcohol.

The liquor was filtered boiling, and brought to a gentle heat; it restored the blue color of litmus paper, and presented a very powerful bitter taste. Left in a cool place, to spontaneous evaporation, in order to obtain some crystals, it became turbid, and deposited, after some time, small white, light flocks of a silky appearance, which M. Caventou supposed to be the active principle of the bark, and which appeared to him to be of an alkaline nature.

These first experiments concluded, the yellow aqueous supernatant liquid was examined to ascertain the nature of the acid combined with the base supposed to exist in the bark of cail-cedra. It was evaporated to dryness, and dissolved in concentrated alcohol; this alcohol was colored yellow, and left undissolved a white salt, which was studied in the second place.

From the investigations made by M. Caventou concerning this liquor, it results that the alkalinity can be due only to the existence of magnesia in these various solutions; it was necessary then, in order to obtain this bitter principle isolated, to free it completely from magnesia. As absolute alcohol only partially separated it, it was necessary to have recourse to another means.

M. Caventou evaporated to dryness the alcoholic solution obtained as above, and triturated the residue with a few crystals of oxalic acid, so as to form acid oxalate of magnesia. He then added a little water, which removed both the acid oxalate of magnesia formed and the excess of oxalic acid, and left the bitter principle isolated. After having washed and dried it, a new alcoholic solution was made of it, which this time was neither alkaline nor acid with reddened or blue litmus.

It was then demonstrated that the bitter principle contained in the bark of cail-cedra must be a principle, which, probably, played the part of an acid with the magnesia, and formed with it compounds capable of dissolving in alcohol, and of forming in it silky crystals.

After having obtained this principle by two other methods, M. Caventou, convinced that this organic principle is peculiar and quite distinct from those already known, has designated it by a name of its own, and calls it Cail-cedrin.

Cail-cedrin, obtained by the means indicated above, is always alike. It is a solid body, opaque, of a resinous appearance, yellowish, and of a non-crystalline form; when it is fused and cooled, it is brittle, and is easily reduced to powder. Its fracture, like that of many of the resins, has a vitreous appearance; its taste is very bitter, and slightly aromatic. It has no action on the colored reagents; calcined in a crucible, it fuses, carbonises, and decomposes without leaving any residue.

When it is treated with water, if the temperature be raised progressively towards 60° or 70° F., it begins to soften, acquires a deeper color, and, if the heat be continued towards 158° and 186° F., it fuses, and assumes a thick syrupy consistence. On cooling, it resumes its resinous yellowish appearance, and again becomes brittle.

Light does not appear to exert any influence on it; however, I have remarked, on several occasions, that a very thin layer of this substance, spread on the bottom of a platinum capsule, decomposed the luminous rays very well.

Cail-cedrin is sparingly soluble in water; it appears to be less so in hot water than in cold. Although its action on water is slight, it seems to form a whitish hydrate, in the form of a granular powder; when absolute alcohol is poured on this hydrate, it removes water, and furnishes a slightly colored solution; moreover, when this hydrate is heated in water, it takes a deeper color, and seems thus to lose the water which it had previously absorbed; and this idea seems confirmed by its retaining, on cooling, the yellow color it had acquired by boiling. This hydrate is not crystalline.

Cail-cedrin is more soluble in water containing in solution mineral salts, such as sulphate of lime or chloride of potassium, which salts exist in the bark.

It forms, with lime and magnesia, true combinations, soluble in water and in concentrated alcohol; but, if caustic lime be made to act on cail-cedrin with the aid of heat, the bitterness almost entirely disappears.

Alcohol dissolves it in large proportions. It is insoluble in ether; but as it possesses much affinity for fatty matter, when it retains a certain quantity of it, it dissolves very well, even when combined with a small quantity of lime salt.

To conclude the history of cail-cedrin for the present, a small quantity of this body was dissolved in water, and the solution was treated with nitrate of silver, bichloride of platinum, perchloride of iron, nut galls, oxalic acid, and oxalate of ammonia. None of these bodies gave any precipitate; tannic acid alone gave a very abundant white precipitate, which completely re-dissolved in an excess of the acid.

Neutral acetate of lead gave a slight cloudiness.

If to all these characters of cail-cedrin be added its action on the animal economy, as stated further on, it is quite evident that it is a new organic proximate principle.

Undoubtedly, many experiments are necessary for completing its study, such as its elementary analysis, the action of mineral bases on it, and the compounds it forms with them, the action of acids and salts, &c. M. Caventou hopes, in a few months, to be able to resume them. It is necessary, also, to establish a fact of great importance with respect to this principle; whether it exerts, as everything leads us to suppose, a salutary influence on persons laboring under fever; this will constitute its value as a manufacture.

Cail-cedrin is accompanied in the cail-cedra bark by a considerable quantity of red and green coloring matters.

The following is the process of isolating which M. Caventou prefers:—

After having powdered the bark it is exhausted by successive decoctions, until the water is no longer bitter. The coloring matter is then separated by means of subacetate of lead, the decoction is filtered, evaporated to dryness, and washed to remove the salts soluble in water; the mass is then treated with oxalic acid, dissolved in water, which forms, with the excess of lead, an insoluble oxalate; the whole is drained on a filter, after having been well washed, to remove the excess of oxalic acid, and afterwards redissolved in alcohol, which is boiled with a little charcoal. It is again filtered, and the liquors are concentrated to the consistence of a fluid extract, then a little water is added, which dissolves the yellow coloring matter, and leaves the bitter principle of the bark isolated.

The red coloring matter of the cail-cedra is presented in the pulverulent form of the color of dried blood; it is sparingly soluble in water, insoluble in ether, sparingly soluble in cold, and more soluble in hot, alcohol; not crystalline; without action on blue or reddened litmus; tasteless. This matter was submitted (without heat) to the action of water, ammonia, potassa, and acetic acid; it did not undergo any change. The smallest quantity of caustic potassa in boiling water was sufficient to dissolve considerable quantities of it.

Sulphuric acid carbonised this coloring matter in a few minutes.

Submitted to the action of nitric acid—and this M. Caventou thinks is its most striking character—there is a disengagement of red vapors; and if the chemical action be aided by heat, on evaporating to dryness, a residue is obtained, which dissolves readily in water, communicating to it a fine canary-yellow color, and of an excessively acid taste.

This solution, filtered, and treated with lime water, gives a whitish precipitate totally insoluble in water, and in concentrated acetic acid, soluble in the mineral acids. From this it is evident that nitric acid decomposes this coloring matter, converting it into oxalic acid.

The green fatty matter appears to be very analogous to that of quinquina; it is aromatic, and adheres strongly to the fingers. Treated cold with caustic potassa, it forms a white soap, the green substance (chlorophylle) which colored it being separated;

but he had too small a quantity of it to extend his researches farther; he intends hereafter to study it more in detail, in order to ascertain if it contains the elements of a crystallisable volatile fatty acid, analogous to that which the fatty matters of many vegetables contain.

From M. Caventou's researches it results that the bark of cail-cedra contains:—1. Cail-cedrin (a bitter principle); 2. Green fatty matter; 3. Red coloring matter; 4. Yellow coloring matter; 5. Sulphate of lime; 6. Chloride of potassium; 7. Phosphate of lime; 8. Gum; 9. Fecula; 10. Waxy matter; 11. Ligneous matter.

An experiment made at the Hotel Dieu by M. Moutard-Martin, in concert with M. Chomel, seemed favorable to the employment of this substance in intermittent fever. If we add this fact to those which are well known, afforded by the natives of Senegal, who cure the most violent attacks of fever with the aqueous decoction of the bark, we cannot but conceive well-founded hopes of the utility of cail-cedrin in therapeutics.

ON TITANIUM.*

EXTRACT FROM A LETTER FROM PROFESSOR WÖHLER TO M. PELOUZE.

It has hitherto been supposed that the cubic crystals of titanium, which are very often met with in the scoriæ of furnaces, were metallic titanium; I have just ascertained that these cubes are formed of cyanuret and nitroguret of titanium; they contain 18 per cent. of nitrogen, and 4 per cent. of carbon; their formula is

$$Ti\,C^2\,N + 3\,Ti^3\,N, \text{ or } (Ti\,Cy + 3Ti^3\,N)$$

. I have also proved that the titanium obtained by H. Rose's method is a nitroguret of titanium containing 28 per cent. of nitrogen; its formula is $Ti^3\,N^2$.

The cubic crystals fused with hydrate of potassa gave rise to ammoniacal gas.

These same crystals, heated in a current of chlorine, produce a liquid chloride of titanium, and a crystallised and very volatile body, which is a combination of cyanide and chloride of titanium; this latter body may be obtained directly by putting chloride of titanium in contact with gaseous chloride of cyanogen: the gas is absorbed with disengagement of heat.

By heating the cubes to redness in a current of steam, the latter is decomposed, and hydrogen gas is obtained as M. Regnault has already stated; but ammonia and hydrocyanic acid are also formed. The titanic acid which remains presents the same octohedral form as anastase; it is *artificial anastase*.

I have succeeded in forming the cubic crystals by heating in a forge a mixture of titanic acid and ferrocyanide of potassium.

With regard to the simple nitroguret, it is very easily obtained by heating titanic acid to redness in a current of ammoniacal gas, cyanogen or hydrocyanic acid. This body always has a very remarkable metallic lustre.

By this same process I have been able to obtain the nitrogurets of several other metals, which I am now studying.

* *Comptes Rendus*, No. 19, Nov. 5, 1849.

ON THE ACTION OF PHOSPHORIC ACID ON CHOLESTERINE.*

BY C. ZWANGER.

Cholesterine is readily decomposed by concentrated phosphoric acid. The products of this decomposition are, like those obtained by the action of sulphuric acid, solid and well defined hydrocarbons: in their physical characters they are plainly distinguished from those obtained with sulphuric acid.

When one part of cholesterine is treated with from six to eight parts of concentrated phosphoric acid and evaporated until the temperature attains 280° F.—the fusing point of cholesterine—it completely decomposes. By the cooling of the fused mass, which must not be heated to a higher temperature, a matter is obtained which loses all crystalline appearance, and which contains two hydrocarbons—cholesterone and cholestearone; these two hydrocarbons are separated by means of boiling alcohol, which dissolves the cholesterone. After having purified it by several crystallisations in absolute alcohol, this body is obtained under the form of brilliant rhombic prisms, terminated by two facettes. These crystals fuse at 154° F. At a higher temperature, the cholesterone boils and may be distilled without alteration. It burns with a smoky flame; nitric acid oxidises it, and sulphuric acid turns it red. It is insoluble in water, sparingly soluble in cold alcohol, more soluble in concentrated and boiling alcohol, and very soluble in ether. It contains on the average:—

Carbon.....	87·78
Hydrogen	12·22
	100·00

As to cholestearone, it is obtained by boiling with ether the residue exhausted with alcohol. By the cooling and evaporation of the ethereal solution, the new hydrocarbon

* *Annalen der Chemie und Pharmacie.*

is deposited under the form of a crystalline mass which it is easy to purify by further solution in ether.

Cholestearone crystallises from its ethereal solution in white, silky needles, which entangle in such a manner as to form a felty mass. It dissolves very difficultly in ether, very sparingly in alcohol, and not at all in water. Its solvents are the fatty oils. It melts at about 347° F. At a higher temperature, it distils and is decomposed. It burns with a smoky flame.

Its composition is expressed by the following numbers:—

Carbon	87·76
Hydrogen	12·24
	100·00

Consequently, it is isomeric with cholesterone.

ANALYSES OF CERTAIN COMPOUNDS OF GOLD AND SILVER.*

BY M. A. LEVOL.

For twenty years I have had to analyse, with all the accuracy of which the art of the assayer is capable, a very great number of samples of native gold, a mineral in which gold is, as every one knows, most commonly allied with silver. The question as to whether these two metals exist in it in definite proportions being still matter of controversy, I have thought that it might not be useless to publish the results of these analyses, especially as they were made with a purely commercial object, and, consequently, free from any systematic bias in a scientific point of view.

	Analytical Composition.†		Theoretical Composition.‡	
First Analysis— Gold from Senegal	Gold.....	845	Gold..... 847	Au^{6} = 846
	Silver	153	Silver 153	Ag = 154
	Copper....	2	,, ,,	,,
Second Analysis— Gold in small bracteæ from Senegal	Gold.....	868	Gold..... 876	Au^{8} = 880
	Silver	113	Silver 124	Ag = 120
	Copper....	9	,, ,,	,,
Third Analysis— Very fine Gold-dust from North America	Gold.....	910	Gold..... 913	Au^{12} = 916
	Silver	87	Silver 87	Ag = 84
	Copper....	3	,, ,,	,,
Fourth Analysis— A very small piece of Gold from California	Gold.....	927	Gold..... 930	Au^{14} = 927
	Silver	69	Silver 70	Ag = 73
	Copper....	4	,, ,,	,,
Fifth Analysis— Gold from Senegal in very large irregular grains	Gold.....	940	Gold..... 941	Au^{18} = 942
	Silver	585	Silver 59	Ag = 58
	Platinum ..	15	,, ,,	,,
Sixth Analysis— Large piece	Gold.....	983	— —	Au^{68} = 981
	Silver	17	— —	Ag = 19

Seventh Analysis—

An ancient crown of gold, found in a Gallic coffin, and which was presumed to be of virgin gold, gave exactly the same as this last piece.§

The different results which I have given above were obtained successively, as I have said, in the course of twenty years, without my having examined whether or not they followed the law of definite proportions; and, when quite recently I thought of calculating them in this respect, I was struck with the degree of approximation at which I arrived. This circumstance induced me to calculate also the results of experiments which I made, some years ago, for another object, and which consisted in inducing the fluxing of different alloys of silver and gold, with the view of studying the phenomena of fluxing in itself. From this work, which was inserted in the *Annales de Chimie et de Physique* (3 série, tome xv., page 55), it resulted:—

1. That, contrary to what was supposed, every alloy of silver and gold, provided that the gold does not predominate, is susceptible of undergoing fluxing.

* *Annales de Chimie et de Physique*; Nov., 1849.

† The 1st, 2nd, 3rd, 5th, and 6th analyses were made with gold previously fused in borax; the others without previous fusion.

‡ The calculations were based on 1227.45 for the equiv. of gold, and 1349.01 for that of silver.

§ M. Boussingault mentions a sample of native gold from Bacaramanga, which appeared also to belong to this kind: its assay was—Gold 98; Silver 2.

2. That the fluxed portion is always less rich in gold than the remaining mass.

The calculation of these experiments leads to the following formulæ:—

	Fluxed Portion.			Remaining Mass.		
	Analysis.		*Formula.*	*Analysis.*		*Formula.*
1st Alloy.....	Silver	902	$Ag^{17}=903$	Silver	863	$Ag^{6}=867$
	Gold.....	98	$Au^{2}=97$	Gold.....	137	$Au=133$
2nd Alloy.....	Silver	962	$Ag^{24}=963$	Silver	941	$Ag^{29}=941$
	Gold.....	38	$Au=37$	Gold.....	59	$Au^{2}=59$
3rd Alloy.....	Silver	958	$Ag^{22}=958$	Silver	938	$Ag^{14}=939$
	Gold.....	42	$Au=42$	Gold.....	62	$Au=61$
4th Alloy.....	Silver	951	$Ag^{14}=951$	Silver	930	$Ag^{12}=929$
	Gold.....	49	$Au=49$	Gold.....	70	$Au=71$

It is evident that the first series of analyses reported in these tables tends to confirm the opinion that gold and silver exist in definite proportions, in argentiferous gold; and the second series seems to indicate that it is the same, with regard to auriferous silver, a result foreseen by M. Boussingault, in his first Memoir on this subject; however, we must not deceive ourselves as to certain results of this second series. For reasons which will readily be understood, and seeking only for truth, I have not thought it right to pass over in silence any of my analyses; but it is evident that gold enters in such small proportions into some of these alloys—for example, in the fluxed portion of the second and third, that, for a difference of only four-thousandths between one and the other, the calculation leads to formulæ, which differ two equivalents in the silver. To endeavor to obviate this cause of uncertainty, which, morever, does not exist, in the same degree, with regard to my other analyses of auriferous silver I fluxed a new alloy, much more rich in gold—this, in 1,000 parts contained about $\frac{4}{5}$ of silver, and $\frac{1}{5}$ of pure gold; this proportion was chosen in order that the separation might be made exactly, without any addition of silver, which, by complicating the analysis, might throw some doubt on its accuracy.

The following is the result of this experiment:—

Fluxed Portion.			Remaining Mass.		
Analysis.		Formula.	Analysis.		Formula.
Silver	778	$Ag^{13}=781$	Silver.....	732	$Ag^{5}=733$
Gold	222	$Au^{4}=219$	Gold	268	$Au^{2}=267$

What are we to conclude from the whole of these analyses?

It is known that twelve varieties of argentiferous gold analysed by M. Boussingault were divided by him into seven kinds, satisfying the laws of multiple proportions; among my analyses are only three related to these seven kinds; there would appear, therefore, to be between gold and silver an unlimited number of compounds in atomic proportions, some of which are in proportions not according to the laws of definite proportions, such are, for example—

Au. $58+Ag$, $Ag\ 17+Au^{2}$, $Ag^{29}+Au^{2}$, $Ag^{13}+Au^{4}$.

But it must not be lost sight of that we are treating of gold and silver, namely, two isomorphous bodies; it was this that determined me to retain these last three formulæ, which more nearly correspond with the result of the analysis than—

$Ag^{6}+Au$, $Ag^{14}+Au$, $Ag^{3}+Au$.*

Besides that these have over the first the advantage of greater simplicity, for this reason, that with respect to isomorphous substances,

$Ag^{17}+Au^{2}$, $Ag^{29}+Au^{2}$, $Ag^{13}+Au^{4}$,

did not appear to me more improbable than

$Au^{66}+Ag$, &c.

Would it not seem from these results, and, also, from other considerations, that the enunciation of one of the characters of isomorphism should not be that it permits the union of isomorphous bodies, but in porportions which deviating very frequently from the ordinary simplicity of definite combinations are not less atomic.

Be it as it may, it appears to me proved, by numerous facts, that, generally, gold and silver occur in the native state combined in such proportions that they may be reduced to scientific formulæ, and that even certain influences, as, for example, that of fluxing

* $Ag^{6}+Au=\left\{\begin{matrix}\text{Silver } 898\\ \text{Gold } 102\end{matrix}\right\}$ $Ag^{14}+Au=\left\{\begin{matrix}\text{Silver } 939\\ \text{Gold } 61\end{matrix}\right\}$ $Ag^{3}+Au=\left\{\begin{matrix}\text{Silver } 767\\ \text{Gold } 233\end{matrix}\right\}$

may determine, in a mass of auriferous silver in fusion, the production of many varied combinations which appear to be in atomic proportions.

ESTIMATION OF STARCH BY THE HUMID WAY.*

BY H. SCHWARTZ.

This process consists in converting starch into glucose, and in estimating it indirectly by means of Barreswil's liquor. The following is the mode of procedure recommended by the author.

A very alkaline solution of oxide of copper is prepared by mixing sulphate of copper with tartaric acid, and adding to it potassa. It is convenient to employ the following proportions:—

60 grms. of bitartrate of potassa,
20 ,, of carbonate of soda,
40 ,, of potassa dissolved in 200 cubic centimetres of water,
50 ,, of sulphate of copper dissolved in 100 cubic centimetres of water.

The solutions are mixed in such a manner as to obtain a blue liquid, which is filtered, and to which sufficient water is added to form a pint (demilitre) of test liquor.

Ten grammes of pure fecula are then weighed out; this is converted into glucose by boiling with dilute sulphuric acid, and the solution is diluted with sufficient water to form 500 cubic centimetres of normal saccharine liquid.

Instead of taking pure starch, an equivalent quantity of white sugar-candy may be used to convert it into glucose. To 10 grammes of fecula correspond 10·555 of cane sugar.

Afterwards take 50 grammes of the cupreous test liquor and add to it, boiling all the time, normal saccharine liquor until the blue solution is completely decolored. The quantity of normal liquor employed is noted; suppose this to be 50 cubic centimetres, which would correspond to 1 gramme of fecula.

If now 10 grammes of flour or any other feculent substance be treated in the same manner, a pint (demilitre) of a saccharine liquor less rich in sugar than the normal liquor will be obtained. To decolor 50 cubic centimetres of test liquor, it will require, for example, 75 cubic centimetres of the new solution. These 75 cubic centimetres will correspond to 1 gramme of fecula. The 500 cubic centimetres, consequently, contained 6·666 grammes, and the 10 grammes of flour contained 6·665 grammes, or 66·66 per cent. of starch.

* *Annalen der Chemie u. Pharmacie.*

MEMOIR ON CERTAIN PHENOMENA OF REDUCTION.—NEW METHOD OF SEPARATING IRON FROM ITS COMBINATIONS.*

BY M. J. A. POUMARÈDE.

Some years ago, in a memoir which I had the honor of communicating to the Academy, the special object of which was to show the action of certain metals, and principally that of zinc, on certain metallic solutions, such as those of the salts of iron, manganese, nickel, &c., I endeavored to demonstrate that the decomposition of water, and the disengagement of hydrogen observed in these reactions, could not be attributed to the zinc, as was at that time generally done, but to a certain quantity of the metal of the solution, which, on account of the antagonism which is always set up between two radicals in presence of a limited quantity of oxygen, is forcibly excluded from the solution, and forms, in being superposed on the reducing metal, the element of a battery which promotes this decomposition, and all the reactions observed in such a case. To prove, decisively, that this is exactly what takes place, it must be established that this reaction, which must be expressed by the formula—

$$2\,(Fe^2\,O^3\,3SO^3) + Zn^3 + HO = Fe^3\,O^3\,3SO^3 + Zn^3\,O^3\,3SO^3 + FeO + H,$$

might, also, be explained by—

$$2\,(Fe^2\,O^3\,3SO^3) + Zn^3 + HO = Fe^3\,O^3\,3SO^3 + Zn^3\,O^3\,3SO^3 + HO + Fe.$$

This is, indeed, what I made it by a quasi-mechanical means. Under the influence of rapid agitation I prevented the fixation of the reduced metal on the zinc, and, consequently, the formation of the battery in question, so that, instead of hydrogen, I obtained a corresponding quantity of iron in the metallic state.

Since these first results I have devoted myself to many investigations. I have tried many experiments, in the hope of deducing from these various effects of antagonism some simple principle which might embrace a collection of facts, and which might give us clearer and more accurate ideas concerning elective affinity than we at present possess; but I must own that my researches in this regard have been nearly fruitless; they have led me, however, to observe certain facts, which, although they deviate a little from the original plan of my work, may not be uninteresting, and as there does not exist amongst them all any very great connection, I will confine myself, in this brief summary,

* *Comptes Rendus*, No. 20; Nov. 12, 1849.

to grouping only some of them which have particularly led to the reduction of some combinations of iron, and on which rest three new modes of metallic reduction which I propose.

In the first part of the memoir which I now present, I demonstrate that the salts of protoxide completely obey the principle which I noticed as regards the salts of peroxide, namely, that by means of a slight elevation of temperature, zinc removed half the oxygen from the salts of protoxide of iron, and that a corresponding quantity of iron was expelled from the solution, under the form of metallic precipitate. I describe, in detail, the simple and inexpensive processes by means of which we may easily obtain very large quantities of this product, which, it appears to me, should find application in industry.

Iron thus obtained, although much less pure* than that which I now have occasion to describe, is, however, purer than that of commerce. Its color is that of ordinary iron, of which, besides, it possesses all the properties. Its specific gravity is 7·50.

The part performed in the foregoing reaction by the intervention of a slight elevation of temperature, led me, in the second part of my memoir, to examine in succession the action of zinc on salts of iron at different temperatures, and to reduce chloride of iron by zinc in vapor.

The iron obtained by this process, which is applicable to the reduction of a certain number of chlorides, is always presented under the form of dendritic crystals, amongst which are perceived, here and there, crude tetrahedra which have not yet been described. Its purity is so great, when it has been obtained in cast iron cylinders, that it does not perceptibly decompose water, except under the influence of sulphuric acid.

The influence of a certain quantity of charcoal, which I always introduce into the foregoing reduction, induced me to reflect on the manner in which this combustible body should act in this case and in reductions effected in close vessels, and recalled to my mind, besides, the very just and accurate ideas of MM. Leplay and Laurent concerning cementation, and led me definitively to a very simple little application of facts already well known, which forms the subject of the third part of my memoir, and which seems to me to become the commencement of other more important applications.

If, into a cylinder of cast iron, placed vertically in a reverberatory furnace, the upper part of which communicates by means of a very long tube with the atmosphere or with a series of other apparatus, we introduce flat bottomed vessels made of sheet iron, containing a certain quantity of colcotar or carbonate of iron, and between which has been laid charcoal contained in frames of metallic or iron wire cloth, and if the cylinder be then heated to redness, we observe, as long as the operation lasts, a disengagement of oxide of carbon, which may be turned to account to produce other reductions; and, when this disengagement has ceased, and the apparatus is quite cold, it is unluted, and we find that the oxide of iron or carbonate of iron has undergone complete reduction, and in its place we have iron in the spongy non-pyrophoric state, which gave me no indication of carbon, and besides possesses all the properties of very pure iron.

To explain this reaction, we must admit, as the two chemists whom I have already quoted did in an analogous reaction, that the air of the apparatus at once forms a first portion of oxide of carbon, which reacts on a corresponding quantity of oxide of iron; this produces a double quantity of oxide of carbon, so that, by virtue of the continuous and progressive action in this way, the oxide rapidly finds itself in a reducing atmosphere which, as I have frequently had opportunities of proving, effects the reduction of the oxide so much the more promptly as it is, within certain limits, were moveable.

I may add that my reason for dwelling in my memoir on this mode of reduction is because it appears to me to reduce, in a very prompt manner, a host of compounds, and particularly the alkaline and earthy sulphates, to which reductions I shall have occasion to recur.

* This part of my memoir is the result of observations made a long time ago, and which I was the first to make.

ON THE TARTRATE OF CALCIA.

BY JOSEPH DANSON,
Student in the Liverpool Coll. of Chemistry.

In going through several qualitative experiments for Dr. Muspratt, I found that, on mixing chloride of calcium, tartaric acid, and ammonia, the whole solidified into brilliant silvery-looking crystals, which were washed on a filter until the liquid, percolating, gave no indications of ammonia or chloride of hydrogen. It was then dried in vacuo over sulphuric acid. It is sparingly soluble in cold, and more soluble in hot water.

Analysis of the Salt.

I. ·2270 grms. gave ·1165 grms. of sulphate of calcia = ·0479 calcia = 21·10 p. c.

II. ·2443 grms. gave ·1245 grms. of sulphate of calcia = ·0512 calcia = 20·95 p. c.

			Theory.	Centesimally Represented. Found.		Mean.
8	Eq. Carbon....	48	17·85	—	—	—
4	,, Hydrogen..	4	1·49	—	—	—
10	,, Oxygen....	80	29·74	—	—	—
2	,, Calcia	56	20·81	21·10	20·95	21·02
9	,, Water	81	30·11	—	—	—
		269	100·00			

Formula—2 CaO, $C^8H^4O^{10}$ + 9 aq.

Sir Robert Kane mentions* a salt of tartrate of calcia with 8 equivalents of water. I am led to believe that the above is the correct formula, as my determinations of calcia were made with the strictest accuracy.

EXAMINATION OF THE LIQUID OF HYDATID CYSTS (ECHINOCOCCI.)†

BY DR. W. HEINTZ.

Dr. W. Heintz has made an analysis of the liquid contained in some hydatid cysts, which had formed in the liver of a woman. The quantity of the liquid which he procured amounted to about three pints. It was colorless, and, with the exception of a few flakes, which rapidly subsided, was clear. These flakes consisted of Echinococci or of smaller cysts. The specific gravity of the clear filtered liquid was 1.0076. It was rendered slightly alkaline by the presence of carbonate of potassa and soda, contained no ammonia, and only an extremely small quantity of albumen. It did not contain any sulphuric acid, and mere traces of phosphoric acid.

Of organic matters, kreatinin was sought for in vain by the use of solution of chloride of zinc, neither were urea, uric acid, nor other definite organic substances present. The only organic compound which could be obtained from it was the soda salt of an acid, which, if not a new acid, appears to be succinic acid; at least it agreed with that acid in its properties, so far as the quantity of the substance admitted of comparison. It was precipitated from its solution by absolute alcohol in the same form as succinic acid from amber, in an experiment instituted for comparison. It was somewhat soluble in ether, very difficultly so in water, had a strongly acid reaction, and formed with lime a salt which was soluble in water, and which fused at 356° F. When examined by Lassaigne's test, it was found to be free from nitrogen. The crystalline form of the acid from the hydatid cysts, and true succinic acid after sublimation, when compared, were found to be perfectly identical.

An analysis of it could not be made, because the total quantity of acid obtained amounted to only 0.25 grammes. The most advantageous method of procuring the acid from the hydatid liquid, appears to consist in evaporating the latter to a syrup, treating the residue with muriatic acid and agitating the mixture with ether. By recrystallising the residue left by the ether after evaporation, the acid is readily obtained in a state of purity. In its quantitative analysis, in accordance with the foregoing details, the inorganic constituents of the hydatid liquid alone remained to be examined, because succinic acid was the only organic substance which could be detected; the amount of this acid was determined by ascertaining the quantity of carbonate of soda, which remained in the ash after incineration. The result is of value only provided the supposition of the absence of all other organic acids is admitted.

Excluding the traces of phosphoric acid and albumen, 1,000 parts of the liquid, containing 986.76 water and 13.24 solid residue, consist of:—

Chloride of calcium	0.46
Chloride of magnesium ..	0.20
Chloride of potassium	0.24
Chloride of sodium	3.85
Succinate of soda	3.41
Extractive matter	5.08
	13.24

OBSERVATIONS ON THE ESTIMATION OF LIME.*

BY ALVARO REYNOSO.

The estimation of lime is one of those which chemists most frequently have to make; and, as it is always made in the state of oxalate of lime, it is important to

* *Elements of Chemistry*, page 894.

† *Jenaïsche Annalen für Physiologie und Medicin.*

* *Comptes Rendus*, No. 20; Nov. 12, 1849.

know all the properties of this salt, if we desire to avoid error.

It is with this view that I have undertaken some experiments on the action of soluble salts, capable of forming insoluble oxalates in reacting on oxalate of lime.

Oxalate of lime is converted, under the influence of a soluble salt of copper (chloride, sulphate, or nitrate), into oxalate of copper. The presence of lime in the liquor separated from the oxalate of copper formed, has been proved. The precipitate formed by the mixture of one equivalent of chloride of calcium and one equivalent of oxalate of ammonia, is dissolved in chloride of copper, poured in all at once; but, after long repose, the liquor being agitated or boiled, a precipitate is formed, whose analysis shows it to be oxalate of copper. When the chloride of copper is gradually added, the oxalate of lime is converted into oxalate of copper, and, at the same time, a soluble salt of lime is formed; the oxalate of copper is precipitated, and does not redissolve in an excess of chloride of copper. The fact of the solution of oxalate of lime in chloride of copper, and of the subsequent precipitation of oxalate of copper, seems to be analogous to that which occurs when ammoniaco-magnesian phosphate is prepared in presence of a great excess of hydrochlorate of ammonia. This property does not belong exclusively to the chloride of copper, since other salts (chloride of calcium, hydrochlorate of ammonia, and chloride of sodium), likewise retard the precipitation of oxalate of copper.

Oxalate of lime, in presence of a great excess of some salts (chloride of sodium, chloride of calcium, and hydrochlorate of ammonia), dissolves in chloride of copper, even when the latter is added drop by drop. However, in this case, it is necessary to avoid vibrations as much as possible, as they would occasion the formation and precipitation of, oxalate of copper, which does not dissolve in the excess of copper salt; moreover, this precipitate is formed after a certain time.

When an excess of oxalate of ammonia is poured into chloride of calcium, and when a salt of copper is afterwards added, there is no solution. We obtain a precipitate of oxalate of copper, and a soluble salt of lime remains in the liquor; but if this experiment be made in presence of an excess of hydrochlorate of ammonia, the oxalate of copper does not immediately precipitate, and the solution remains clear for some time.

Oxalate of lime, boiled with soluble salts of silver, lead, cadmium, zinc, nickel, cobalt, strontia, and baryta, undergoes double decomposition, and there remains in the liquor a soluble salt of lime, and a precipitate of oxalate of one of these metals.

Thus oxalate of lime is decomposed by all the soluble salts of metals capable of forming insoluble oxalates and soluble salts of lime.

The decomposition is still better effected, as the equivalent of the metal which has to replace the lime is higher.

I mean to extend this investigation to all the oxalates, and to examine more generally the action of soluble salts on insoluble salts.

NEW MODE OF MANUFACTURING AND DETECTING IODINE.

BY CHARLES WATT, JUN.

THE method of manufacturing iodine now in use is that originally proposed by Dr. Ure, slightly modified, and consists in saturating with dilute sulphuric acid the residuary liquor from the incinerated ash of the sea-weed, after having removed as much as practicable of the valuable salts by crystallisation, and adding a certain quantity of manganese.

On heating the mixture, iodine sublimes over, and is collected in suitable receivers. In the reactions which take place, sometimes a rather considerable quantity of the iodine is wasted in consequence of its coming over in combination with chlorine, and even when this is not the case, it sublimes over with a large quantity of water, from which it is not easy to free it. It is afterwards subjected to hydraulic pressure, which, although it presses out a great quantity of the water, seems, if I may use the expression, to press the remaining portion more completely into it.

The method which I propose as a substi tute for the one in use, is to dry the saline mass, and then to mix with it a suitable quantity of manganese. To this mixture is added a saturated solution of quite neutral chloride of zinc, sufficient in quantity to make the mass into a paste. The mixture is then subjected to distillation as usual, and the iodine comes over with the greatest facility.

This method of procedure will be found useful to detect the presence qualitatively and quantitatively of iodine existing in combination with any metallic body.

To test the presence of iodine by the above method it will be found sufficient to fuse a small piece of the chloride of zinc in a test glass, having added a small quantity of manganese, and to drop the substance we wish to examine into it, when, if an iodide be present, iodine will be rendered evident by the color of its vapor or by its action on a piece of paper steeped in starch.

So delicate is this mode of testing the presence of iodine that by adding one drop of a solution of iodide of potassium containing 1 grain in an ounce, I could, by the color of the vapor, easily recognise the presence of iodine.

I tested the value of this method of preparing iodine from its combinations, by operating on mixtures containing a known weight of an iodide, and I was enabled, in every case, to recover the quantity of iodine which represented the quantity of iodide employed; this I hope will be a sufficient proof of the practicability of the process, the whole of the iodine being set free.

The only precautions which I have found it necessary to observe in this process, are to employ a quite neutral solution of chloride of zinc; to be certain that the solution of zinc be one concentrated; that a sufficient quantity of it be used; and that the temperature is raised high enough. With these precautions I am sure that a greater quantity of iodine, and that more free from impurities, may be obtained from the same amount of kelp liquor.

INGOTS OF COPPER OBTAINED BY A PRECIPITATION OF THE METAL FROM ITS SOLUTION.*

When copper in solution is precipitated, it is usually in the state of a fine loose powder. The following fact, however, observed by M. Mollerat, in his manufactory for the preparation of vinegar from wood, in Burgundy, will show that ingots of copper may be obtained, *via humida*. In the process of preparing sulphate of copper, by calcining the copper with sulphur, solutions of the sulphate are obtained, which become turbid by the separation of a soluble sub-sulphate. These are placed in a tub, half sunk in the ground, to become clear, when it is observed that small buttons of metallic copper are formed on the interior surface of the tub, and always at the junction of two staves; and, there is no doubt that these buttons would ultimately become masses of considerable magnitude. M. Mollerat considers that the chemical action by which the copper is revived may be easily accounted for in the following manner:—The protosulphate of copper, which unquestionably exists in the solution, deposits its base in passing to the state of deuto-sulphate, giving up its acid to form the new salt. It is not, therefore, this part of the phenomenon that appears particularly deserving of notice; but the cohesion acquired by the copper so precipitated from the midst of its solution—a tenacity so great as to admit of the metal being hammered into leaves in the cold state, the specific gravity of which is equal to that of fused copper.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

PRESERVATION OF TIMBER.

(PAYNE'S PROCESS.)

The purposes for which wood is employed in construction are so important, and the cases in which it would be superior to its great rival, iron, if it were sufficiently durable, are also so numerous, that any preservative process which will effectually obviate its natural tendency to decay, must be of great value. Our forefathers were well aware of this, and adopted various plans for effecting the safety and durability of their buildings; in an old house in France, lately pulled down, the massive oak girders were found to have the ends, which rested in the walls, closely covered with cork. In recent years, many chemical processes have been tried, but nearly all of them have had, more or less, the vice of solubility, and, therefore, of tendency to short duration.

The method proposed and patented by Mr. C. Payne was founded on certain single and double decompositions. He claimed in his patents the exclusive use of all earths, metals, alkalis, and acids, the combination of which produces single or double decomposition. Thus his original and main plan is, to inject sulphate of iron into the cells of the wood by means of exhaustion and pressure, and then to inject chloride of calcium (muriate of lime) by similar means. The decomposition of these materials produces a white precipitate which crystallises in the wood, consisting of sulphate of lime, an insoluble substance, and with this a small quantity of chloride of iron, which is soluble; this latter substance is harmless while there, but when exposed to

* *Patent Journal*, Dec. 15th, 1849.

certain influences evaporates, and leaves solely the intensely hard insoluble sulphate of lime in the wood. This assertion, however, of the insolubility of sulphate of lime must be modified, as carbonate of potash has a slow effect in dissolving it. For frame buildings, or other constructions on soils containing a large proportion of potash, Mr. Payne uses the sulphuret of barium, or of calcium, for the first solution, and then decomposes it by sulphate of iron for the second solution; the produce of these, viz., sulphate of baryta, is perfectly insoluble, at least, so far as is known chemically at present. Neither of these agents has, however, been found to be absolutely proof against the seaworms (*Teredo Limnoria*, &c.), although the action of the worms is found to be very slow in timber thus prepared in comparison with their ravages in unprepared timber. The cause of this comparative failure is not yet apparent; whether it be due to the still unknown agency* by which the worms work, or to the action of saline constituents of the ocean on the chemical agents employed, yet remains to be proved.

To draw an analogy from a peculiar circumstance in another material, it may be concluded that a remedy is possible. It is found that the teredo attacks almost all stones with nearly as much virulence as it does wood; but it has never been known to touch Portland stone, and the probable reason assigned is, that Portland stone contains a proportion of silica. Now if silicate of potassa be substituted for the sulphuret of barium or lime mentioned above, and decomposed as before by sulphate of iron, it would probably be found to be a complete antidote to the seaworm. The practical objection to the use of this form of the process is found in the great expense of procuring the solution of silicate of potassa. There are also other substances which, when decomposed, may prove equally effectual.

The value of this process, when applied to the common woods of this country, is very great. Out of many known instances of this, a striking one may be given, in which that comparatively useless wood, beech, became, after preparation, far superior to oak unprepared. On the Bishopstoke and Salisbury Railway prepared beech and unprepared oak sleepers were laid in a very wet, unfavourable soil: after two years it was found that the oak was rapidly decaying, while the beech sleepers were perfectly hard and sound. In building a warehouse in Manchester, it was ordered that the flooring of the lowest, or cellar, floor should be prepared by Payne's process, as the situation was exceedingly damp, and, indeed, at times, water covered the floor. The timber used was common white pine, and as the quantity prepared was found to be insufficient, the builder finished the work with unprepared

* At a recent discussion at the Institution of Civil Engineers in London, on the action of the seaworms in wood, Dr. Lyon Playfair stated that the action of these animals formed the subject of investigation of a Committee of the British Association, consisting of Professor Forbes, Dr. Carpenter, and himself. The two theories on the subject were the "chemical action," and the "mechanical action;" and it was obvious that the chance of finding a complete prevention to the ravages of these worms must depend much on a previous discovery as to the manner of their action. By the chemical theory, the effects are said to be produced by the evolution of carbonic acid currents from the animal itself, or setting in action those which always exist in seawater, and thus effecting a dissolution of the structure of the wood. But the worm will bore equally well in wax and similar substances which carbonic acid will not affect. Turning, then, to the mechanical theory: it is is supposed that the surface of the "borer" (it cannot be called head), is hardened by silicious matter, which enables it to penetrate hard substances. But chemists can find no trace of silica. In short, neither theory is founded on sure knowledge at present; but it is hoped that the investigations in progress may throw light on the subject.

Dr. Buckland declared there could be no doubt on the subject; and that the action was entirely mechanical. He said it was not necessary that the animal covering should be silicious to produce an effect even harder than steel; e.g., you can strike light with a steel on the tooth of the hippopotamus, and strike off pieces of steel while the tooth remains uninjured, yet it contains no silica. He said that the "borer" has an indurated shelly surface with ridges like a file, and is worked in a rasping manner by two muscles, fixed one on each side of the valves, and that this accounts for the noise said to be audible. On examining with a microscope the holes made by the Pholades in limestones, the surface is seen to be ridged, as if worked out in that manner. A chemical action in this case would produce a smooth surface. He estimated the rate of working of the animals in these stones at one inch in depth in one thousand years.

Mr. Lovell Reed on the other hand said it was impossible the action could be anything but chemical.

timber of the same kind. At the end of two years the latter part was quite rotten and was replaced by new work; at the end of the next two years this was also removed, being quite rotten. The prepared timber in this fourth year was perfectly sound and hard. A common objection made by builders and architects to the process is, that it must destroy the elasticity of the timber. To test this, a series of experiments have been made on girders of the following sizes, cut out in balks carefully selected; in each experiment two similar pieces out of the same balk were used, one prepared and the other unprepared. There were 17 double experiments, 3 on girders, with 18 feet between the points of support, and of sizes, 12¾ inches in depth, by 3 inches in width; 6 on pieces, with 12 feet between points of support, and of sizes, 6 inches by 3 inches, and 6 inches by 2½ inches; and 8 on pieces, with 8 feet between points of support, and of sizes varying from 6 inches by 1¾ inch, to 6½ inches by 2½ inches. In the first experiment of the long girders, with 2 tons 3½ cwt., the deflection in each was the same, and the elasticity not injured. In the second, with 2 tons 5½ cwt., left on during 45 hours, the prepared piece had a deflection of 0·075 inches more than the unprepared: and in both instances, on removing the weights, the pieces were found to have a slight set. In the third, both pieces were "crippled," with a deflection of 2 inches; but the unprepared piece attained that amount with 1 ton 15 cwt., while the prepared piece required 1 ton 19 cwt. In the remaining experiments the general result was, that both elasticity and ultimate strength were the same in both pieces.

An ornamental value is given to English woods by the use of this process of which few have any idea of. Specimens of ornamental furniture have been made of English woods, Paynised, which vie in beauty with the richest descriptions of Eastern or American woods. Ash, alder, oak, red oak, maple, pear, yew, cherry, sycamore, elm, walnut, laurel, beech, &c., &c., will all, after preparation, bear competition with their far more costly rivals from the east or west.

As a preservative against fire, however, the process is of the greatest value and is worthy of the closest attention.

A compulsory use of it for all buildings where fire is used would tend greatly to diminish the annual losses and distress caused by the fearful ravages of fire. It is well known to the proprietors of alum pits that planks used in them very soon become uninflammable. In Payne's process, the anti-fire department consists of injecting first sulphate of alumina, and sulphate of iron, and then decomposing them with chloride of calcium. Timber thus prepared is quite uninflammable; if exposed to a very strong red heat, it will gradually char away, but will never take or communicate flame. This fact has been more than once strikingly proved. If the process were used for the fittings of emigrant ships we should be spared those soul-harrowing details of a ship fire on the trackless ocean, which have been but too frequent in recent years, when the superabounding population of the old world has been flying by thousands from misery and distress to seek a better fortune where nature's bountiful gifts are poured out to overflowing on the green plains of the far west, or in the rich and smiling vallies of our Eastern colonies. It is but too true that in England we are too rich in the products of genius and talent, to estimate at their proper value many advantages which lie under our hands, and which, if employed as intended by the great Giver of that genius and talent, would, each in its proper sphere, diminish the miseries which appear to be the lot of man, and promote that happiness which he is ever aiming at, but too seldom attains.

J. N. W.

ANALYTICAL INVESTIGATIONS CONCERNING THE RED COLORS EMPLOYED IN PAINTING ON PORCELAIN.*

BY M. SALVÉTAT,

Chemist to the National Manufactory of Porcelain at Sèvres.

THE reds used in painting on porcelain occupy an important place in the art; it is by means of these colors that figure painters obtain their carnations; it is with them, and colors derived from gold, that flower painters represent red and pink flowers; landscape painters, also, very frequently use them.

They are prepared with oxide of iron, which has been subjected to a temperature varying according to the tone which it is desired to obtain. It is known that the tint of oxide of iron varies from orange red to deep violet red, according to the temperature to which it has been carried. The oxide of the tone required is mixed with three times its weight of grey flux, composed of 1 part of borax, 2 of sand, and 6 of *mine orange*, ground without fusion.

Notwithstanding the simplicity of these proportions, and the facility of preparing pure oxide of iron, reds for porcelain rank

* *Annales de Chimie et de Physique*, Nov., 1849.

among those colors which it is very difficult to obtain with all the qualities desired.

The first reds of fine quality were made by Dihl, who obtained them with an oxide which he procured, it is said, from Prussia; Bourgeois, a skilful chemist of Paris, likewise made them of great beauty; but the reds which have acquired most celebrity were those prepared by M. Pannetier for Madame Jaquotot, and which appear in all their brilliancy in the works of that celebrated artist. The most skilful painters agree in recognising in these colors a brilliancy, a transparency, a fusion, which the reds of other chemists do not possess.

M. Pannetier's series of reds is composed of eleven shades, graduating from orange to grey in the following order:—

	Nomenclature of Sèvres.	
Orange....	No. 55	Orange red.
Red, No. 1 ..	56	Capuchin red.
Red, 2 ..	58	Blood red.
Red, 3 ..	62	Flesh red.
Red, 4 ..	63	Carmine red.
Red, 5 ..	64	Red Lake.
Iron violet, 6 ..	66	Pale violet red.
Iron violet, 7 ..	66 A...	Violet red.
Iron violet, 8 ..	66 B...	Deep violet red.
Iron violet, 9 ..	66 C...	Very deep violet red.
Iron grey, 10 ..	66 D...	Iron grey.

These tints, from the first to the last, form a series of types which we do not always succeed in approaching, especially in the preparation of the extremes; we have hitherto made nothing approximating to either orange red or the iron grey in question.

I have thought that it would be interesting to know whether oxide of iron alone could give this gradation of tint, commencing with orange red No. 55, and ending at iron grey No. 66 D, and in cases in which these shades could be obtained only by mixtures, of the nature of these mixtures, and in what proportions they should be made. It has also appeared to me useful to prove if there were a complete identity between the flux employed by all chemists and that used by M. Pannetier; the qualities of the latter cannot be doubted, owing to the skilful employment of it by Madame Jacquotot, during her brilliant artistic career. Finally, I desired to know whether the relative proportions of the flux and of the coloring principle were those indicated in all chemical works.

These various considerations induced me to analyse M. Pannetier's reds, and it is the result of these labors which has enabled me to considerably improve the reds of Sèvres, limiting myself, moreover, to the analytical data which I present here;—

I. Orange Red (Pannetier).—No. 55. Orange Red (Sèvres).—Orange.—First Chromatic Circle (Chevreul).

This color corresponds in tint with the orange of the first chromatic circle of Chevreul. I shall, henceforth, designate it by this term.

I do not know any chemist besides M. Pannetier who has obtained with iron a tint approaching to normal orange; all the attempts which I had myself made prior to these investigations, by means of pure oxide of iron, uniformly gave me too red a color, always matching the capuchin red which follows that with which I am now occupied. Analysis showed me that there was oxide of zinc in M. Pannetier's orange; this peculiarity, moreover, perfectly explains the slightly ochreous tone of the red in question. Compared with the orange of the first chromatic circle of Chevreul, the orange red of M. Pannetier is, indeed, somewhat deadened—that is to say, broken by traces of brown.

By acting on the color with hydrochloric acid, I detected in its composition silica, boracic acid, soda, and oxide of lead, constituting the flux, and oxides of iron and zinc, with traces of alumina, forming the coloring principle.

The quantitative analysis was made by the following process:—

A previous fusion with carbonate of soda rendered the substance entirely soluble in nitric acid. The solution, evaporated to dryness, gave a deposit of silica, which was put on a filter, washed, calcined, and weighed.

Into the filtered solution was passed a current of sulphuretted hydrogen, which precipitated a large quantity of sulphuret of lead, mixed with sulphur, arising from the reduction of the persalt of iron by the sulphuretted hydrogen. The sulphuret of lead, washed with water charged with sulphuretted hydrogen, was treated with fuming nitric acid, calcined, again treated with sulphuric acid and fuming nitric acid, calcined, and weighed. The quantity of oxide of lead was deduced from the weight of the sulphate of lead thus determined.

The liquor freed from sulphuret of lead was neutralised by ammonia, then precipitated by the hydrosulphate of ammonia with which it was left to digest for 24 hours, in order not to remove any boracic acid. The sulphuret of iron and zinc thus obtained, washed with water impregnated with hydrosulphate of ammonia, was thrown on a filter, then treated with moderately concentrated hydrochloric acid. It was filtered, boiled with nitric acid to peroxidise the iron, and precipitated by an excess of ammonia which formed a bulky deposit of oxide of iron and

alumina. These two oxides were separated one from another by known processes; there were only traces of alumina.

The ammoniacal solution was precipitated by hydrosulphate of ammonia; the sulphuret of zinc, after being well washed, was re-dissolved and precipitated by the carbonate of potassa; the deposit was washed, dried, and weighed.

The water freed from the sulphurets of zinc and iron contained neither lime nor magnesia.

The quantity of matter was too small to admit of the direct estimation of the alkali and boracic acid; they were estimated by the difference, regarding the loss as borax; it will be evident, from the following analysis, that this supposition was correct.

In this color were found.—

	In 0.3900 grammes.	Per cent.
Silica	0·0680	17·48
Oxide of lead....	0·2010	51·54
Borax.....	0·0510	13·08
Oxide of iron....	0·0550	14·10
Oxide of zinc....	0·0150	3·80
Alumina.....	traces.	traces.
	0·3900	100·00

In forming according to these data an oxide composed of oxides of zinc and iron in the proportions indicated, I was able to reproduce without difficulty the orange of M. Pannetier, with the yellow tint at which I had not been able to arrive by using pure oxide of iron.

For this purpose, solutions, made without heat, in hydrochloric acid, of 10 parts of metallic iron and 5 parts of distilled zinc are mixed. It is precipitated by carbonate of soda, washed and dried, after exposure to the air and the oxygen of the washing water have made the greenish deposit pass to the state of peroxide. It is dried, and exposed to a dull red heat; it is finally mixed with 1 part of fourth orange red oxide to 1 of the foregoing oxide of zinc.

This last compound oxide is mixed with a flux formed of sand 1 part, fused borax ¾, *mine orange* 3, in the proportions of 475 parts of flux to 100 of oxide. We will recur further on to the comparison of this flux with the grey flux; but I may remark that the object of the excess of flux was to favor the development of the yellow tint proper to the silicate of lead and iron, whose formation I have already noticed in another case (*Annales de Chimie et de Physique*, 3e Série, tome xv., p. 120).

II. Red, No. 1 (Pannetier).—No. 56. Capuchin Red (Sèvres). — Fourth Orange Red. — First Chromatic Circle (Chevreul).

This red, which presents to the eye less yellow than the foregoing, which, consequently, approaches more nearly to pure red, corresponds to the fourth orange red of Chevreul's first chromatic circle. It is by this name that I intend to designate it. It is very easily obtained with pure oxide of iron. It is, at present, the most orange red which it is possible to obtain with pure anhydrous oxide of iron. I say anhydrous and pure, for the hydrated oxide of iron in which the water may be replaced by oxide of zinc, and, probably, also, by other oxides, without the tint being modified, even at a bright red heat, forms a yellower tint, but deadened—known by the name of ochre, or yellow brown.

Analysis discovered in this red the same elements as in the preceding, with the exception of oxide of zinc, which was entirely wanting; we found, also, some traces of alumina.

The quantitative analysis was with the view of directly determining the soda which was supposed to be contained in the state of borax; the silicic acid was estimated by the difference.

The pulverised matter was acted on by hydrofluoric acid. The fluorides, evaporated to dryness, were converted into sulphates, and these into sulphurets by the addition of sulphuretted hydrogen to the slightly-acidified mixture. As before, the oxide of lead was estimated in the state of sulphate; the excess of sulphuretted hydrogen was driven off, the lead peroxidised by a current of chlorine, then precipitated by ammonia. The oxide of iron was separated from the alumina, as we have already described.

The liquor, deprived of lead, alumina, and iron, was evaporated to dryness; the residue, fused in an atmosphere of carbonate of ammonia, was weighed. From the weight of sulphate of soda was calculated the quantity of soda, which gave a corresponding weight of borax: neither lime nor magnesia was detected.

Thus were found—

	In 1 gramme.	Per cent.
Silica	0·1660	16·60
Oxide of lead..	0·5039	50·39
Borax.....	0·1251	12·51
Oxide of iron..	0·2050	20·50
Alumina.....	traces	traces
	1·	100·00

The oxide of iron of the tint indicated was prepared by calcining sulphate of protoxide of iron; however, the tint in question should be kept at the temperature of about 1,470° F. There is no inconvenience in not attaining

this degree of heat; it is even preferable to remain below it. The oxide is washed with warm water and dried.

III. Red, No. 2 (Pannetier).—Blood Red (Sèvres).—Third Orange Red.—First Chromatic Circle (Chevreul).

Blood red is the truest red, and presents to the eye still less yellow than capuchin red; it corresponds with the orange red of M. Chevreul's first chromatic circle. It is with this color that I have been able to make the *normal* of this first circle; we will call it, therefore, the *third orange red*.

It is obtained with the pure oxide of iron resulting from the decomposition of the sulphate of protoxide by heat, and submitted to a degree of heat somewhat more intense than is required for preparing the fourth orange red.

Qualitative analysis did not detect in this color the presence of any oxide besides those entering into red No. 1.

The quantitative analysis was made without any other modification in the plan adopted for the decomposition of the orange red than was required by the absence of oxide of zinc. This same method was employed in the analysis of the reds Nos. 3, 4, 5, 6, 7, and 8; we shall not, therefore, recapitulate it.

The borax in all these results was calculated by difference; it includes, consequently, the loss in the manipulation.

Red No. 2 was found to be composed of—

	In 1 gramme.	Per cent.
Silica.....	0.1690	16·90
Oxide of lead..	0·4951	49·51
Borax.....	0·1339	13·39
Oxide of iron..	0·1970	19·70
Alumina.....	0·0050	·50
	1·	100·00

IV. Red, No. 3 (Pannetier). — No. 62, Flesh Red (Sèvres).—Second Orange Red.—First Chromatic Circle (Chevreul).

Flesh red bears a designation which indicates its tone very well. It is redder than the foregoing, and it corresponds with the second orange red of Chevreul's first chromatic circle. We shall call it the second orange red. It may not be uninteresting to say here that it is the purest red which has been applied to porcelain, and it must be said, to our shame, but to the praise of artists, who, by skilful combinations, and by happy contrasts, have been enabled, not only to excel in them, but also to cause it to be believed that they possess such colors. We must own that the palette of the painter on porcelain wants reds, and that all the really pure tones corresponding to the first orange red—orange red, 5th, 4th, 3rd, 2nd, 1st red, red, 5th, 4th, 3rd red violet—have not been made hitherto in vitrifiable colors. This is a gap which it is at present difficult to fill up, but it is the only one: the circle comprises 72 colors, and I am able to make the other 60 by very simple processes, which I will soon make known, in order to spread the use of the chromatic table, which must render to the arts and sciences such important services.

In M. Pannetier's red No. 3 were found—

	In 1 gramme.	Per cent.
Silica.....	0·1660	16·60
Oxide of lead..	0·4918	49·18
Borax.....	0·1422	14·22
Oxide of iron..	0·2000	20·00
Alumina.....	traces	traces
	1·	100·00

V. Red, No. 4 (Pannetier).—No. 63, Carmine Red (Sèvres).*

The designation of Sèvres for this red and those which follow it accounts very accurately for the difference of shades which distinguish these colors. They belong to the circles which comprise the dead colors; they do not belong to the first chromatic circle of M. Chevreul. We confine ourselves to making known its composition:—

	In 1 gramme.	Per cent.
Silica.....	0·1630	16·30
Oxide of lead..	0·5002	50·02
Borax.....	0·1368	13·68
Oxide of iron..	0·2000	20·00
Alumina.....	traces	traces
	1·	100·00

(To be concluded in our next.)

REPORT ON THE MEANS PROPOSED BY M. VINCENT, FOR DISTINGUISHING THE TEXTILE FIBRES OF VARIOUS PLANTS.†

BY MM. GAUDICHAUD, BOUSSINGAULT, AND PAYEN.

The Academy will remember that in 1847 the Committee, of which I have now the honor of being the organ, submitted to its approbation a process by means of which M.

* A mixture of nearly equal parts of the reds Nos. 2, 3, and 4, was acted on with hydrofluoric acid. There were found—

Oxide of lead	50·06
Borax	12·12
Oxide of iron	20·50

† *Comptes Rendus de l'Académie des Sciences*, Nov. 5, 1849.

Vincent was able to characterise not only the textile fibres of the *Phormium tenax*, but also threads and tissues prepared with these filaments.

This result was important, for the less resisting and less durable matter in sail-cloth and other tissues used in the Navy might often be very injurious.

The process in question is very simple: it is sufficient to plunge for a minute the threads or tissues to be tried in nitric acid of 36 degrees, containing hyponitric acid; if they are prepared with *Phormium tenax*, a red color is developed, whilst the threads of hemp and flax take no color, or acquire only slight tints under the influence of this reagent.

We may add that these characters are independent of the nature of the proper substance which constitutes the textile fibres, for this substance does not differ in any respect in the different families and species of vegetables; it is the cellulose which, completely purified, does not become colored by contact with the above-named reagent.

It will easily be understood that the *fibres*, threads, and tissues, of whatever nature, may escape special reactions; we have effectively proved this by employing the powerful processes of bleaching, with soda and chlorine, on the various samples of threads and tissues, before submitting them to the tests in question.

But, in all plants, many organic substances different from cellulose, especially nitrogenous, fatty, and resinoïd matters, varying according to the vegetable either in their nature or in their proportions, are met with, adhering to the external and internal surfaces of the long tubes of which the textile fibres consist.

Sometimes several washings with ley are insufficient for eliminating these foreign substances, and in this case also the efficacy of the means proposed is maintained; and this should ordinarily happen in sail-cloth, since they are composed only of raw or imperfectly bleached threads.

These remarks apply equally to the test which M. Vincent, in his communications of May, 1848, and March, 1849, submitted to the judgment of the Academy of Sciences. These new reagents, more delicate than nitric acid, enable us to distinguish the products of phormium from those of hemp and flax, and these two from each other.

The following is the mode of operating:—

The sample of *hemp*, thread, or tissue, is steeped in a saturated solution of chlorine; if it be doubted that the warp and woof are formed of similar threads, a few threads are removed from the two sides of an angle of the small square of linen, in order to be able to judge separately the coloration of the threads projecting from the two edges.

After a minute's immersion in the chlorine, the samples are removed, and placed on a porcelain plate, and a slight excess of ammonia is poured on each of them; the special colors are immediately developed.

The products of *Phormium tenax* take a bright red color, which becomes dull, and turns brown in a minute. French hemps washed in running water, and Italian hemp acquired an orange tint, which became deep in a minute, without attaining the tint, or the intensity of color of the phormium.

French hemps, prepared by soaking in stagnant water, assume deeper tints than the foregoing, but which cannot be confounded, by practised eyes, with the brighter, redder, and more intense tints of the same reaction on phormium.

French flax, soaked in stagnant or running water, acquired, after immersion in water, and after a minute's contact with ammonia, a weaker tint than the hemps; this tint, however, resembled that developed in the hemp soaked in running water, so much that doubts might exist, if the rose tint manifested by hemp in the first instance had not been recognised.

Cotton gives such feeble tints that they will always be easily discerned.

Besides, under the microscope may easily be distinguished the filaments of the cotton tree, flexible, tubular, thin-sided, and easily flattened, from the textile fibres of hemp and flax, which remain cylindrical in the same circumstances, and may even be recognised by a practised eye after the triturations which have converted them into paper paste.

M. Vincent has observed the effects of the same reagents on the textile fibres of various plants, and has found none, which, according to these tests, can be confounded with the fibres of phormium tenax.

Although the products of these plants are not at present used in making sails, or other parts of ships' furniture, it was interesting, both for science and the applications which may be made of these filaments, to state their special properties under the influence of the same reagents.

Among the monocotyledonous and dicotyledinous exotic vegetables of various families:—Malvaceæ, Bromeliaceæ, Urticeæ, Thymeleæ, Ligumenæ, Musaceæ, Theliaceæ, and Asclepiadeæ, the author has examined the textile fibres of the following plants:—

Agave Americana and fatida, Hibiscus Cannabinus, Bohemeria, Oua-Ouké, La-

getto, Crotalaria juncea, Abaca, Corchorus capsularis, Asclepias gigantea.

Nitric acid, containing hyponitric acid, produced red or rose tints in all, except Asclepias gigantea, whose fibres underwent no change.

The above-mentioned textile fibres, which are colored red or rose by nitric acid, underwent, under the successive influence of chlorine and ammonia, different colorations, but all belonging to the violet red tints.

Ammonia turns yellow the fibres of the *Hibiscus*, of the *Lagetto*, and of the *Abaca*, whilst it has no action on *Agave Americana* and *fœtida*, *Bromelia caragala* and *karatas*, *Bohemeria*, *Crotalaria*, *Corchorus*, and *Asclepias*.

The aqueous solution of iodine colors these textile fibres yellow, except those of *Bromelia karatas*, which do not change color; the *Bohemeria* and *Lagetto* take a bluish tint, owing, doubtless, to the feebly-aggregated amylaceous or cellular matter.

It will be remembered that Malaguti discovered this property in certain varieties of hemp. M. Vincent has ascertained that it belongs to the products which have been steeped in running water, and that it does not exist in hemp which has been steeped in stagnant water; that is probably owing to the alteration produced in the amylaceous matter in such circumstances. But it is, at any rate, a very curious observation.

Finally, M. Vincent has remarked that all the filaments of these plants are colored yellow by the solution of potassa, except those of *Asclepias gigantea* which remain colorless.

The new and interesting investigations of M. Vincent have appeared worthy of attention, especially on account of their utility, for preventing errors and frauds in the position and application of textile matters and tissues supplied to the Navy; to perfectly characterise, as well as to distinguish from each other several agricultural and commercial products of great importance.

The easy and certain processes which he has described enable us especially to recognise the threads and tissues of *Phormium tenax*; which products are ill-named, for they are less tenacious than the fibres of hemp and flax, and lose their tenacity more in bleaching.

We have the honor of proposing that the Academy grant its approbation to the careful researches of M. Vincent, and to forward this Report to the Minister of Marine, and the Minister of Agriculture and Commerce.

The conclusions of this Report were adopted.

ON THE EXTRACTION OF GOLD FROM COPPER ORES, CONTAINING VERY SMALL QUANTITIES OF IT.*

BY MM. ALLAIN AND BARTENBACH.

In concluding a former note, we announced our intention of transmitting to the Academy the results of experiments undertaken with the view of determining definitively the process to be followed for practically extracting the gold contained in the copper ores of Chessy and Sain-Bel; we now fulfil this engagement, and, with so much the more readiness, as the mines in question, being very extensive, their working may become very important. It results from our investigations, that from these copper ores $\frac{1}{2000}$ of gold may, on the average, be extracted. Consequently, the density of these minerals being about 4, 1 cubic centimetre represents 800 grammes of that metal. The operations, which are easy and quick, are divided into two series —roasting and extraction.

Of the Roasting.—The whole of the sulphurs may be removed by simple roasting in the air; but a long time is required for the ore to be in a fit state. The roasting is much expedited if the ore, after the second roasting, be reduced to a paste with a saturated solution of chloride of sodium; sulphate of soda is formed. The chlorides of potassium and calcium act in the same manner as chloride of sodium. It does not occur, however, so promptly in using these chlorides, as by heating the powdered ore, after the second roasting, with nitrate of potassa, soda, or lime. Peroxide of manganese, mixed with the ore, also gives satisfactory results. Oxygen, chlorine, nitric acid, aqua regis, the direct agents of the above-mentioned compounds, evidently remove the sulphur with more rapidity. But the most practical and most efficacious means of operating the roasting consists in the employment of sulphuric acid. It is the most efficacious, seeing that the sulphur, under the form of sulphuric acid, serves to remove the sulphur; and that this metalloïd, in oxidising, either in the air, or at the expense of the oxygen of its compound, furnishes more sulphuric acid than is required, if care be taken to make the sulphurous vapors of the various roastings pass into leaden chambers; it is the most practical, because we employ an agent one of whose elements forms one of the principal constituents of the primitive matter. Sulphuric acid is also preferable for removing

* *Comptes Rendus*, No. 21; 19 Nov., 1849.

the oxides of zinc and copper formed, since it very readily makes the slightest trace of sulphurets, which may have escaped the roasting, pass to the state of sulphates.

Thus, with sulphuric acid, or, rather, with the very sulphur of the ore, it is brought to the state fit for being acted on, with the view of dissolving the gold.

Of the Extraction.—Chlorine, in the dry state, attacks gold; but the operation presents practical difficulties. With chlorine, dissolved in water, chloride of gold is readily obtained; only the treatment must be repeated several times, in order to remove the whole of the metal. Aqua regia, without heat, likewise dissolves gold; the reaction is naturally more prompt, with the aid of heat; in both these cases there is always a large quantity of chloride of iron in the solution. Mercury also acts on gold ore, principally when this latter, roasted as much as possible, has afterwards been heated to a high temperature. With regard to the separation of the gold from the iron, which the liquor contains, among the following reagents, viz.—iron, zinc, copper, lead, mercury, sulphurous acid, sulphate of protoxide of iron, carbonate of potassa, and carbonate of soda, iron and mercury are the most remarkable.

The following is the most convenient mode of extraction:—

The ore being roasted in pieces in the air, with the view of rendering it more friable, after pulverisation it is sifted through the finest brass sieve, and again roasted as much as possible—that is to say, until the powder has a homogeneous brown tint. It is afterwards made into a paste with sulphuric acid at 66°, and roasted for the last time, until no more sulphurous or sulphuric acid is disengaged. The matter is then powdered as finely as possible, and boiled with dilute sulphuric acid. The insoluble part is washed, and treated, with the aid of heat, with aqua regia diluted with water, but made beforehand in the proportion of 6 parts of hydrochloric acid at 21, and 1 part of nitric acid at 36°. This is an important point. The liquor containing the chlorides of iron and gold (and even copper, for it is difficult to entirely remove this metal by a single boiling with sulphuric acid) is put in contact with iron, which precipitates gold and copper. When the precipitate is collected, washed, and dried, it is calcined in the air in order to oxidise the copper. The gold may be freed from the oxide of copper, and even the oxide of iron (for a little of the latter is almost always precipitated in the cementation), by sulphuric or hydrochloric acid; but separation by fusion, by chlorine or by mercury, is preferable. If we form the chloride, it is reduced by heat; the amalgam, the mercury is volatilised. Such are the chief scientific facts connected with the practical extraction of gold from pyrites containing this metal even in less quantity than those of Chessy and Sain-Bel, the process we have described being applicable to all pyrites containing gold. The expense of extracting one kilogramme of gold from the ores of Chessy and Sain-Bel, the value of the copper obtained being deducted, did not exceed 400 francs (£16).

NEW PROCESS FOR EXTRACTING SUGAR FROM THE SUGAR CANE.*

BY M. MELSENS.

The following account of the new and important method of extracting sugar from the sugar cane, is abridged from the first of two long articles recently published in the *Courrier de l'Europe*.

The great difficulty which has been experienced up to the present time in the preparation of sugar, has been owing to the rapidity with which it, when dissolved in water, alters by exposure to the air in hot climates. It must, however, be clear, since the cells of the sugar-cane are themselves full of sugar, dissolved in water, and this solution can be kept for a long time in them, without undergoing any alteration at all, that if the same conditions which exist in nature could only be obtained in practice, there is no reason why an artificial solution of sugar may not be kept unaltered for a considerable space of time; or, in other words, why water should not be used for the purpose of dissolving the sugar out of the crude juice expressed from the cane.

The difficulties, indeed, are not owing to the sugar or to the water, but to the air, and the ferments produced by its action on the crude sap of the sugar cane. The object of M. Melsens was, then, to exclude the air from the sap when extracted from the cane, and to prevent the formation of any ferments which might change the character of the saccharine matter. This he has succeeded in doing by availing himself of the well-known affinity of sulphurous acid for oxygen gas. Sulphurous acid, however, alone was found not to answer the purpose; the sulphuric acid, produced by the absorption of oxygen by sulphurous acid acting on the sugar, converts it into grape sugar. This difficulty has been overcome by using sulphurous acid

* *Agricultural Gazette*, Dec. 15, 1849.

combined with a powerful base, which, as the sulphurous acid is converted into sulphuric acid, combines with the latter, and forms an insoluble salt.

The acid sulphites, and more especially the bisulphite of lime, were employed by M. Melsens for the double purpose of preventing fermentation by the action of the sulphurous acid, and of neutralising the sulphuric acid as fast as it is formed, by means of the lime.

Sugar candy dissolved in cold water containing bisulphite of lime, even in excess, crystallised entirely, and without undergoing any change, by spontaneous evaporation, at a low temperature. Several other experiments of the same nature, but differing in their details, always gave the same result; in each the sugar crystallised out by spontaneous evaporation, without any loss either in quantity or in quality, and without any appearance of molasses. In these experiments the sugar dissolved in water, containing bisulphite of lime in excess, was boiled, and then left to evaporate; sometimes after being filtered; sometimes without any filtration at all.

From the experiments which M. Melsens has made with bisulphite of lime, it is probable that if a cold solution of this salt were to be poured on the sugar cane grinder, so as to mix with the juice the moment it is expressed from the cane, the sugar might be kept for some time, and might be exposed to the heat necessary for its clarification without any sensible loss or deterioration.

But this same salt also possesses the property of coagulating, at a temperature of 212° F., milk, white of egg, blood, and yolk of egg mixed with water. At a temperature of 212° F, bisulphite of lime acts as a clarifier. It separates the albumen, caseum, and other nitrogenous matters which are found in the sugar cane. This separation is effected without appreciable loss in the quantity, or deterioration in the quality of the sugar.

Bisulphite of lime, morever, rapidly and tolerably effectually bleaches the colored substances found in the sugar cane; it prevents the formation of other colored matters produced by the action of air on the pulp of the cane; it also stops the production of those which are formed during evaporation, and, above all, of those which require for their developmeat the joint action of air and a free alkali.

It seems that colored substances, which, under ordinary circumstances, are formed spontaneously by the exposure of the pulp of the sugar cane to the air, never make their appearance when bisulphite of lime is employed. By evaporating, at a low temperature, bisulphite of lime mixed with —1, a common solution of sugar; 2, the crude sap of the sugar cane; 3, the juice of beetroot, no coloration was produced. By an evaporation of the same substances at a high temperature, the coloration was scarcely visible; indeed, with red beet-root, the color was completely destroyed, and the sugar obtained was perfectly white.

It seems, then, that bisulphite of lime can be employed in the extraction of sugar; 1st, as an antiseptic, preventing the production and action of any ferment; 2nd, as a substance greedy of oxygen, opposing any alteration that might be caused by its action on the juice; 3rd, as a clarifier, coagulating at a temperature of 212° F., all albuminous, and other coagulable matters; 4th, as a body, bleaching all pre-existing colored products; 5th, as a body, opposing itself, in a very high degree, to the formation of colored substances; 6th, as a base, capable of neutralising any hurtful acids which might exist, or be formed in the juice, and substituting in their place a weak, inactive acid, namely, sulphurous acid.

M. Melsens is of opinion that sugar can be obtained from the sugar cane with no other source of heat than a tropical sun, excepting, only, for the purpose of clarification; indeed, the bisulphite of lime prevents the crude juice of the cane, or the syrup obtained therefrom, from undergoing any changes; great rapidity in the process of crystallisation, indispensable at present, becomes, by using this salt, unnecessary; and, more than this, the quantity of sugar which is now lost in the bagasse, in consequence of the impossibility of washing it out unchanged, can be all collected by being dissolved in water, charged with bisulphite of lime.

The only objection that can be made to the above process is that the sugar obtained by means of bisulphite of lime has a sulphurous taste; this is true, but the taste is completely lost—1st, by crushing the sugar, and exposing it to the air, whereby the little sulphite of lime which there may be is converted into a tasteless sulphate; 2nd, by exposing the sugar to an atmosphere containing ammonia; if this is done, the sugar acquires a very agreeable flavor of vanilla, but is apt to become a little discolored; 3rd, by clarifying it, until it loses 10 per cent. of its weight; by this process, a pure white sugar is obtained, which will bear a comparison with any sample produced at present. The last is the process recommended to be used on a large scale. The quantity of sugar fit for the market, which can be obtained from the sugar cane by adopting sulphite of lime, as above re-

commended, is, at least, double that obtained by the usual processes.

In consequence of M. Melsens having made all his experiments on the sugar cane at Paris; and, therefore, on a small scale, he is not able to state how bisulphite of lime can best be used in the large colonial sugar manufactories; but is compelled to leave the application of the principles on which his method depends to the intelligence of the manufacturers themselves.

In the preparation of beet-root sugar, bisulphite of lime is quite as useful as in the extraction of cane sugar.

ZINCING AND TINNING OF IRON AND CAST IRON.—PROCESSES OF SCOURING.*

BY M. SOREL.

M. SOREL thinks that the success of zincing and tinning iron depends, in great measure, on the scouring, especially as regards cast iron. It is conceived, indeed, that if the acid liberates the carbon of the metal, it becomes impossible to make the tin adhere. Consequently cast iron has not hitherto been tinned in a bath, notwithstanding the advantage which would attach to the being able to tin cast-iron culinary vessels at a cheap rate.

M. Sorel has long employed, in the galvanised iron manufactory, acids prepared by means of organic matters; for example, sulphuric acid, diluted with water, which has been used in the purification of oil for burning. This acid contains an oleaginous matter which gives it the property of detaching and dissolving the oxide of iron without attacking the metals.

Having met with inconveniences in the employment of organic substances, M. Sorel endeavored to find something better in the mineral kingdom.

He ascertained that certain salts, dissolved in acids, may very advantageously be substituted for organic matters. The salts which gave him the best results were those of copper, antimony, and tin. He employs in preference the first two with rather dilute hydrochloric acid, and the salts of tin with water acidulated by sulphuric acid.

We give several compositions which he has used with success:—

1. Water acidulated with sulphuric acid, marking 10° of the acidimeter at the temperature of 60° F., 96 parts by weight: Protochloride of tin 4 parts by weight.

2. The same as the foregoing, plus about 4 parts of salt of copper.

For scouring tin a little more acid and less salts of tin and copper may be used; for cast iron, the proportions are in the opposite direction.

The salts of copper all produce nearly the same effect.

The salts of tin also give good results with the other acids which are employed for scouring iron, such as hydrochloric acid, but in a less degree than sulphuric acid.

3. Hydrochloric acid diluted with a small quantity of water, marking about 15°, 98 parts
Any salt of copper, as acetate, sulphate, chloride, or nitrate ..... 2 ,,

100

These proportions are susceptible of modifications. The quantity of salt of copper may be increased, and another salt may be added, such as sulphate of lead, zinc, iron, or other salts sparingly soluble in hydrochloric acid; hydrate and pyrolignite of the same base also produce good effects.

Dilute hydrochloric acid, in which a salt of copper has been dissolved, possesses, in the highest degree, the valuable property of dissolving oxide of iron without attacking the metal. This composition has also the advantage of effecting the scouring in a few minutes.

We know that the metal is attacked:—1. By a disengagement of gas. 2. By the change of appearance which the acid liquor undergoes, from a rather opaque olive green to transparent and bluish. 3. By the precipitation of copper on the iron: a little salt of copper must then be added to the liquor, which completely re-establishes it.

* *Journal de Chimie Medicale*, Dec., 1849.

FORMULA FOR THE PREPARATION OF LUCIFERS WHICH WILL NOT FULMINATE.

PHOSPHORUS	30	parts.
Glue	60	,,
Sand	10	,,
Water	100	,,

Dissolve the glue in the water with the aid of heat, in a copper flask; add the phosphorus to the solution, which should be, at least, 120° F., stir until cold; add the sand, and stir again to incorporate it with the compound of phosphorus and gelatine produced. With this preparation, lucifers, previously sulphured, are prepared in the ordinary manner.

SPECIFICATIONS OF PATENTS RECENTLY ENROLLED.

Improvements in Cleansing, Scouring, or Bleaching Silk, Woollen, Cotton, and other Woven Fabrics and Yarns, and in Ageing Fabrics and Yarns when Printed. JOHN THOM, Ardwick, Manchester. Sealed May 15th, 1849.

The patentee describes and claims—1. Certain methods of cleansing, scouring, or bleaching the fabric or yarn, by causing it to pass up and down over two series of rollers, supported one beneath the other in a suitable chamber filled with sulphurous acid gas or chlorine.

2. Of "ageing" the fabric or yarn by causing it to pass in a similar manner through a chamber containing aqueous vapor.

Improvements in Expressing and Treating Oils, and in the Manufacture of Varnishes, Pigments, and Paints. HENRY BESSEMER and JOHN S. C. HEYWOOD. Sealed, May 15th, 1849.

The patentees claim—1. Expressing oils or oleaginous substances, by forcing the matters to be operated upon, by means of a piston or plunger, into and through a pervious vessel, the resistance offered by which to the passage of the matters containing the oil will cause it to be expressed therefrom. (On the same principle, apparently, as the cane-juice expressing apparatus of Mr. Bessemer.)

2. Subjecting the matters containing oil to the action of pressure in water, so as to cause the oil to combine for a time with the water, and thereby facilitate its expression from the matters in which it is contained.

3. The application of a metal bath or air-bath in the manufacture of varnishes and in boiling oils.

4. A method of withdrawing and condensing the vapors arising in the manufacture of varnishes and boiling of oils.

5. The use of phosphate of lime and oxide of tin in the manufacture of paints and pigments from vitreous materials, for the purpose of giving greater body and opacity to the color.

6. The devitrification of the materials used in the manufacture of paints and pigments, for the purpose of obtaining body and opacity.

7. A mode of giving motion to the grinding surfaces used in the manufacture of colors.

Improvements in Tanning Hides and Skins; and, also, in Dyeing Fabrics and Substances. ANDREW CROSSE, Middlesex. Sealed May 24th, 1849.

The patentee disclaims the latter part of the title of his patent, "*and, also, in dyeing fabrics,*" stating that his invention consists—

1. In subjecting skins or hides, for the purpose of unhairing them, to hydrosulphate of lime, which is obtained by passing sulphuretted hydrogen through lime and water.

2. In submitting the skins or hides, during the process of tanning, to electric or galvanic actions, by placing a plate of lead and a plate of zinc on opposite sides of the pit, and connecting them by a metal strap above the level of the water. The skins are suspended in the pit for a week, in water, which is converted into ooze or tanning liquor, of a strength of 15° sacchorometer, by the addition of bark. Or the water is removed, and ooze substituted for it. The strength of the ooze is successively increased 5° every week, until it attains 45°, when the tanning operation is completely.

The patentee claims—1. Subjecting skins or hides to hydrosulphate of lime.

2. The employment of the means for producing electric or volcanic effects during the tanning of skins or hides.

Improvements in the Manufacture and Refining of Sugar and Saccharine Matters. REES REECE, London; and ASHLEY PASTON PRICE, Margate, Kent. Sealed May 24th, 1849.

THE patentees claim:—

1. The use of hyposulphite of lime, the hyposulphite of magnesium, the hyposulphite of barium, the hyposulphite of strontium, either singly or in conjunction with the solutions of acid sulphate of alumina, acid acetate of alumina, or acetic acid, as defecators of sugar and saccharine matters.

2. The use of the hyposulphite of alumina as a defecator of sugar and saccharine solutions.

3. The use of the hydrosulphuret of the sulphide of magnesium, the bisulphuret of magnesium, or the sulphurets of magnesium; the hydrosulphuret of the sulphide of calcium, or the sulphurets of calcium; the hydrosulphuret of the sulphide of barium, the bisulphuret of barium, or the sulphurets of barium; the hydrosulphuret of the sulphide of strontium, the bisulphuret of strontium, or the sulphurets of strontium, as precipitants of lead or of any of the salts thereof, which may be found in solutions of sugar or saccharine matters.

4. Subjecting saccharine solutions, for the purpose of removing any sulphuretted hydrogen which may exist in a free state or result from the decomposition of the sulphurets employed, to the combined action of heat, from steam or otherwise, and a vacuum, or boiling in vacuo.

5. The use of sulphurous acid, or the hyposulphite of alumina, or the hyposulphites which, when treated with an acid, or otherwise, produce or liberate sulphurous acid as a primary or secondary decomposition to remove any excess of sulphuretted hydrogen.

6. The use of saccharate of lime, saccharate of baryta, or saccharate of strontia, to neutralise any acid which may be found in solutions of sugar or saccharine matters resulting from the employment of the acid sulphate of alumina or the acetate of alumina.

7. The use of saccharate of lime, of baryta, or of strontia, as the source of carbonate of lime, carbonate of baryta, or of carbonate of strontia, which are produced by passing carbonic acid gas into solutions of these saccharates, and also the application of any of these carbonates in the refining of sugar or saccharine matters.

8. The use of saccharate of lime, of baryta, of strontia, or of magnesia, as a source of hydrated saccharate of calcium, of baryta, of strontia, or of magnesia, which are produced by passing hydrogen gas into solutions of these saccharates until none of the same is absorbed, to neutralise any acid or decompose any salt which may exist in solutions of sugar or saccharine matters resulting from the employment of lead.

9. The use of bicarbonate of alumina, or bicarbonate of magnesia, as a defecator of sugar or saccharine matters.

10. The use of the soluble sulphites as defecators of sugar and saccharine matters.

11. The use of the soluble sulphites in the treatment of canes, or beet-root, for the purpose of extracting saccharine matters therefrom.

12. The use of the soluble hyposulphites in the treatment of canes or beet-root for the purpose of extracting saccharine matters therefrom.

Improvements in depositing Metals, and in obtaining Motive Power, part of which Improvements are applicable to certain other similar useful purposes. STANHOPE B. SMITH, Birmingham. Sealed June 7th, 1849.

The patentee describes and claims,—

1. The dissolving of salts of silver in hydrocyanide of potassium, calcium, ammonia, barium, strontium, aluminum, or magnesium, to produce solutions for plating, either with or without the employment of electric currents.

2. The use of seleniuret of calcium, iodine, iodide of nitrogen, gun cotton, or xyloidine, sulphur salts, sulphuretted oils, creosote, xanthates, bisulpho-carbonate of the oxide of methyle: acetic hydrochloric chloroacetic, hydrocyanic, hydrosulphocyanic, hydrosulphuric, selenious, sulphurous, sulphovinic, tartaric, and xanthic acids; added to solutions of salts of silver to produce bright silvering.

3. Manufacturing articles by the electric deposition of metals on the exterior and interior surfaces of the same mould (using for that purpose a mould composed of some material such as gutta percha, which is fusible at a lower temperature than the metals, so that it may be melted and run out from between them).

4. The use of gutta percha to make the moulds for manufacturing articles by electric deposition; also, the employment of solutions of gutta percha to stop out portions of conducting surfaces, as may be required.

5. The use of hydrogen, evolved from voltaic batteries, as a motive power, the same being mixed and detonated by hydrogen and atmospheric air.

6. The use of solutions of gutta percha to form the etching ground, when such etching is effected by electricity or acids.

[These specifications of chemical patents are taken from the "Mechanics' Magazine," published by Mr. Robertson. In a former No. we also availed ourselves (as regarded one specification) of the material afforded by the "Patent Journal," published by Messrs. Barlowe and Payne. We have to apologise for our perfectly inadvertent neglect to acknowledge the sources from which these articles were derived, an omission for which the editor of the former periodical calls us to account; we hope, however, that he will acquit us of any intention to appropriate the labors of others, without the courtesy usual in such cases. At the same time, if he will carefully compare the specifications as they appear in his excellent periodical, and in THE CHEMIST, he will perceive that they are *not "literatim et verbatim"* the same, as we have found it necessary, in some instances, to slightly curtail, and in others, to alter chemical terms, for which alterations we alone are responsible.]

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

SANITARY NOTES.

NO. IV.

January 1st, 1850.

A YEAR of dread has passed, and one of hope has dawned.

During the past year many thousand victims have fallen a prey in this island to a disease the origin and action of which is still a mystery, but whose bosom companion is Filth. The destroying angel in his ruthless course has spared neither young nor old, neither rich nor poor, when found within the influences of his precursor demons. The dread of his red hand has spread from lowest hovel to loftiest palace. Many an unaccustomed prayer for relief, and many a vow have risen to the throne of mercy; but, alas! those prayers and vows have borne on their every breath a testimony against the negligence of man. May this be so no more! Let those that have wealth, those that have talent, those that have industry and energy, bring of their substance to the high altar of charity, if not to that of self-preservation, and it may still be hoped that the sweet savour of the sacrifice may stay the avenging hand.

Let it no longer be said that the poor may die of thirst, or drink putrid ditch water, because a grasping monopoly refuses them, save at an impracticable cost, a supply of that element of life's subsistence, which God gave free and unfettered for the use of men and beasts and plants. Let it no longer be said that deadliest poisons shall distil in the heart of every town, and contaminating that pure free air, which is man's right, as it is also the necessity of his existence, deal out from death new lurid streams to swell the dark overflowing river of death. Let it no longer be said that our poor shall be compelled to live in habitations which the wealthy would be ashamed to keep their cattle in. Let it not be said that Filth and Misery, with their foul companions, Ignorance and Debauchery, shall be permitted to reign paramount in any one corner of any one of the thousand towns of this free and wealthy land.

To take a lower stand.—Let it not be longer said, that the inhabitants of this land, whose merchants are princes, and whose traders are of the highest citizens of the world, are so careless of their private and dearest interests, that they had rather, at double the cost, support widows and orphans out of the parish rates, than prevent the men from dying prematurely; that they are indifferent to the annual waste of manure to the amount of many millions sterling, which, if applied to its natural use, would produce, in rich abundance, food for starving thousands, and support for the distressed tillers of the soil; that they, not unwillingly, pay from two to four times as much, for an article of necessary and vital consumption, as they ought to pay; that they will longer permit the poor to herd together in buildings, so completely undrained and unventilated, that those noxious gases are ever being generated in them which originate or propagate infectious and contagious diseases, and which, by the well-known law of diffusion, must and do carry those diseases, and their consequent sorrows, into their own fair homes.

Englishmen are commercial men, and humane men. It is proved, in every phase of the social economy, that humanity is far more profitable than indifference. For humanity's sake, then, and for profit's sake, let Englishmen contend earnestly with the foul fiends of filth and disease; let them bring that energy and determined purpose, which has carried them through many difficulties, to the task of improving the sanitary and social condition of their fellow-beings, and thereby elevating both their physical and moral character; and, without doubt, the hand of an all-seeing and merciful Providence will not fail them, to give fixedness to their endeavors.

May the year 1850 be marked with white chalk on England's annals, as the year when the onslaught began on the domains of disease, which eventuated in effecting a high standard of health and morality throughout the British Isles, and as the year in which the painful, and often thankless, but earnest and energetic labours of the sanitary pioneers, began to receive their high reward in the increased comfort and happiness, and the grateful blessings of their fellow-countrymen.

Subjoined are a few note-book jottings, presented now for general consideration, with the hope that good fruit may arise from them, to be reported in "THE CHEMIST" for January, 1851:—

NOTE 1.—The cholera funerals in London

are estimated to have cost, at the lowest average prices, upwards of £200,000. It is probable that the actual outlay has far exceeded that amount.

Note 2.—The additional charge in the parish of Lambeth, for the support of the widows and orphans of men carried off by the cholera exceeds £300 per annum; the capital represented by which would suffice, by judicious management, to put Lambeth in a healthy condition. In how many more places would this be, also, the case?

Note 3.—A low estimate (made by Professor Liebig) of the amount of human excretiæ, liquid and solid, places it at 1½lb. per day, or .28 ton per annum for each person; or, 280 tons for each thousand of the population of a town. In Flanders, this amount would be worth £1,850. In England manure of this kind, when mixed with an equal weight of peat charcoal, has been found to have higher fertilising power than guano, which is worth £7 or £8 per ton. But suppose it worth only £5 per ton; then, as the value of the charcoal is under £5, the value of the other must be taken at about that sum. The value of the 280 tons must, therefore, be estimated at £1,400, at least, in England. In every place, then, where this is suffered to go to waste as sewage, there is an actual loss of the most universally fertilising manure to the amount of £1,400 a-year for each thousand of the population.

Note 4.—At Hull the neighboring farmers fetch away all the night-soil from the town; and so great is the demand for it, that, in many cases, the collectors pay for the right of fetching it. At Clitheroe, sewage water, used for manuring land, produced an increase of crops as 4 to 1. At Mansfield, the Duke of Portland spent £30 per acre to prepare poor land for sewage irrigation, and the value was ultimately raised from 4s. 6d. to £14 per acre. At Willesdon, by the use of sewage manure, ten crops have been taken from what was previously bad land. At Ashburton, land, irrigated in this manner, is worth £8 to £12 per acre; while other land is only worth 30s. to 40s. per acre. The instance at Edinburgh has long been known.

Note 5.—The cost of water in one large district of London is 10d. for 1,000 gallons. In three other large districts it varies from 6d. to 6½d. per 1,000 gallons. (It is true, in a fifth large district, the charge is 4½d., but that is for dilute sewage water.) The supply is scanty and intermittent, and the average rate is 32s. 6d. per house, without high service. At Nottingham the charge is 2½d. per 1,000 gallons; and the engineer there states that, for a larger town, it would be 2¼d. The supply is constant, and the average rate is about 7s. 6d. per house, with high service.

In London the ordinary charge for a four-roomed house is 20s. At Bristol the charge for a four-roomed house is 7s.; at Manchester it is 6s.; at Preston it is 9s.; at Ashton it is from 8s. to 12s.

In some parts of London, where courts are supplied twice a week only, the charge to the landlord of each house in the court is 14s. At Nottingham, Preston, &c., the charge to the landlord, for a constant supply to laborers' cottages, is from 4s. 4d. to 5s. 6d. per annum.

The abuse and tyranny of the present system of water supply in London will hardly be remedied until, either some public control is established over the Water Companies, or the management of the supply is taken altogether under the administration of a Public Board.

J. N. W.

THE PIMLICO SEWER CASE, AND THE STATE OF THE PUBLIC SEWERS.

It was our intention to have earlier entered into a consideration of the Sewer question, more especially in connection with the case at Pimlico, in which the five lives were lost: but we have delayed our remarks to see whether any of the chemists whose attention was directed to this case made any further reports, or whether any fresh light might be thrown on the subject, which we cannot but deem a very important one.

Most of our readers, doubtless, are aware that the point at issue between the parties engaged in this inquiry is, whether the sewage water of the Pimlico sewer did or did not contain "Cyanogen compounds," or, in other words, whether the refuse gas lime (lime used in the purification of coal gas), which was placed near the sewer, contributed to the unhappy event, the particulars of which have long been before the public. It is stated by Dr. Ure and Mr. Lewis Thompson, that not only were they able to detect the presence of cyanogen, but that they obtained what the Dr. calls a "vendable" quantity of prussic acid, while, on the other hand, Mr. Lyon Playfair and the other chemists, stated that such was not the case;

indeed, Mr. Playfair has stated that he would not mind drinking all the prussic acid obtainable from a very large quantity of the sewage water.

We have more than once examined the refuse lime from the gas-works, and can testify to its containing cyanide of calcium,* from which hydrocyanic acid would be evolved by the action of carbonic acid and moisture. We had intended, at the time these investigations were going on, to have procured samples from the sewer in question, but, being very much occupied, and being aware that our esteemed friend and former contributor, Mr. Lewis Thompson, was prosecuting the inquiry, and knowing, from long and extensive personal observation, that no one could possibly be found better (and very few so well) fitted for the task than Mr. Thompson, we determined on leaving it entirely to him, in the most perfect confidence that by him the truth, and that alone, would be developed.

Although we hold it as clearly proved that cyanogen compounds were present in the sewage-water at Pimlico, and probably added their baneful effects to the other noxious gases present, still we think that the gases evolved in so confined a space by the decomposition of the organic matters contained in the sewage, the evolution of sulphuretted hydrogen and carbonic acid, and the removal of the oxygen from the atmosphere would have been sufficient to account for the deaths.

The sewers of all large towns, and particularly those of the metropolis, from their great extent, were a source of great complaint during the summer of the year 1849; and those who have passed over the gratings during the flushing operations, or whose doors were near these disgusting outlets, have, in many cases, unknowingly, inhaled their death-warrant. From our own experience, we can affirm that they were, indeed, loathsome in the extreme; they are, even now, during the cold weather, far from what they ought to be. At the period alluded to, we were struck with the sagacity of some of the residents near Fleet-street—in the courts and alleys—a class of persons who have little but instinct to guide them—(if we more frequently obeyed the dictates of instinct, we might do wisely); these people in many instances placed old mats, &c., over the gratings, to confine the foul gases and prevent them from insinuating themselves, as they did, in many instances, into their bedrooms.

We consider that the present is the season when something should be done to remove this abomination: the task would not be a difficult one, and would amply repay the trouble and expense. Should the summer of this year, on its arrival, find us unprepared for the attacks of epidemic disease, what fearful results may we not anticipate! What shall we not DESERVE!

We have seen that the gaseous matters evolved in a confined space by the decomposition of those substances which find their way into sewers, are capable of instantaneously destroying animal life; we urge, therefore, that it is reasonable to suppose that their evacuation into the air we breathe and in the immediate vicinity of our dwellings, although, by their becoming diluted, their effects, being less prompt, are not so marked nor so easily traceable, must still expose those influenced by them to the ravages of epidemic diseases, and we know these deleterious compounds to be capable of generating febrile disorders, the majority of which, from their being gradually induced, become constitutional, and, consequently, baffle the skill of the medical practitioner.

Numerous suggestions have been made for the remedy of the present disgraceful state of our sewers—a state which is gradually becoming worse, from the accumulations which take place in the small "house drains" from the deficient supply of water to the houses, want of care on the part of the inhabitants, and the constantly increasing length

* The fact of gas-lime containing cyanogen is very curious. The destructive distillation of coal is the only instance with which we are acquainted of the formation of cyanogen without the presence of a base, such as potassa or soda, unless, in this case, ammonia acts the part. This effect is worthy of note from the fact that in the decomposition there is more than enough hydrogen present to convert the whole of the nitrogen into ammonia. The study of this might lead to some practical result.

f the sewers. It is certain that water and a system of ventilation, which will keep the gaseous emanations from these sewers from commingling with the air we breathe, are indispensably necessary. Let these two desiderata be supplied—the supply of water to carry, by the force of its current, the solid matters through the sewers, and ventilation to remove the gases, and it will matter but little whether or not substances containing cyanogen find their way into the sewers.

We cannot leave this subject without most earnestly urging on the public the necessity for individual cleanliness as regards their own drains, as a duty which they owe to themselves, as well as to their neighbours; nay, to their Almighty Maker, and likewise to interest themselves in the subject generally, so that the main sewers may not be neglected, and allowed to accumulate the filth which during another season may send, prepared or unprepared, to a premature grave, thousands of their fellow creatures.

If these points are properly attended to, it will matter little hereafter whether or not a certain sewer contains, "Cyanogen compounds" in either the fluid or the gaseous state, save as a matter of knowledge, and the science or rather the profession of chemistry will not be again degraded in the sight of the public, by such exhibitions as that which has induced these remarks.

SANITARY OBSERVATIONS RELATING TO ARTICLES OF FOOD, DRINK, ETC.

BY CHARLES WATT, SEN.

It is scarcely possible to notice a subject which has elicited more public attention or more scientific discussion than the sanitary state of large towns.

Important as are the subjects of drainage, ventilation, and the supply of pure water, I conceive that good, sufficient, and wholesome food, unadulterated beverages, good clothing, and dry shelter, demand almost as much consideration. Unfortunately, it is not possible to ensure to every one plenty of food and good raiment, but it is the duty of the Legislature to protect the people against the wicked frauds to which articles of food are subject, to regulate the construction of the dwellings of the humbler classes, and to enforce the demolition of such habitations as are likely, from any cause whatever, to engender disease amongst those whose poverty compels them to seek for low-rented residences.

With regard to food; let every one take a circuit of the different markets in the metropolis, and particularly on a Saturday night; in every butcher's shop, especially in the poorer districts, is exposed for sale meat of the most inferior kind, and often the produce of beasts which, had they not been killed, would very soon have died of disease. I have lately taken a journey round some of the markets, and have seen innumerable instances where the lungs and livers of sheep have abounded with tubercles, and even in a state of suppuration, and affected with hydatids. Can the flesh of these beasts be fit for human food? Is not the very idea perfectly disgusting? I have, also, seen numerous instances where the viscera of oxen and calves were in a similar state; and the flesh of such beasts is sold to the poor—God help them!—with no one who has the knowledge to detect, or the power to prevent, these evils.

Bread is another article, made up in various populous districts of such materials as are not only injurious, by their direct action on the digestive organs, such as alum, which tends to produce constipation, and others to derange the functions of these viscera; but the flour of inferior grain, and also potatoes, which, as they contain very little real nutritive principle, exert an injurious tendency.

Porter is another article forming an important item in the sustenance of the working classes, and this is the subject of adulteration so injurious and extensive as to constitute a very serious cause of disease. Let any one procure a sample of porter from one of the great breweries, and obtain another from some public-house or gin palace supplied from the same establishment, and he will find the article so different that he cannot recognise it as the same beverage, as regards either flavor or quality. It is dosed with treacle and water, sulphate of iron, salt, and various other substances, all added to increase the quantity, and thus to injure public health and defraud the revenue. It cannot be held as harmless to have a quantity of saccharine matter in water continually poured into the stomach to undergo decomposition and impair the functions of that organ, and especially when combined with the chemical agents with which it is treated.

Gin is another article much adulterated: as met with in the gin palace, it frequently contains a portion of sulphate of zinc (white copperas), put in for particular objects, and is made to assume artificial strength by

stimuli, spirits of turpentine, and other ingredients. It is possible that the alcohol may be as injurious as any portion of this filthy compound, yet that is no reason why poison should be superadded. These things require attention, and at a very early period I shall call public attention to them, after strict and minute analysis.

In conclusion of these brief remarks, I may add that good clothing, and habitations free from damp, are also matters of the highest importance in the improvement of the healthy condition of large towns, and especially as regards the poor, who must be unable to secure these necessaries, and, therefore, exposed to all the dire disasters consequent on the want of them.

"A MEMBER BY EXAMINATION OF THE PHARMACEUTICAL SOCIETY OF GREAT BRITAIN"—HIS "INFALLIBLE RESTORATIVE MIXTURE," "ANTECEDENT LOTION," AND "PECTORAL COUGH CANDY."

We know not whether the Pharmaceutical Society takes upon itself to inflict any punishment, such as suspension of membership, or expulsion, on those members who disgrace the honorable profession which is essential as a qualification for the certificate. It appears to us that those pharmaceutical chemists who descend to the infamous quackery of issuing small bills setting forth the miraculous powers of their secret medicines, should be unhesitatingly and unsparingly chastised.

We have before us a filthy specimen of this class. It is a handbill, issued by a fellow who styles himself, we know not how correctly, "Member by Examination of the Pharmaceutical Society of Great Britain." It eulogises the empiric's "*Infallible* Restorative Mixture" as "A safe and effectual remedy for every disease incident to the sexual organs, such as gonorrhœa, gleet, seminal weakness, fluor albus or whites, pains in the loins, kidneys, lumbago, gravel, irritation of the bladder, &c., possessing great advantages over many of the vile nostrums frequently offered to those suffering under the above lamentable diseases (unlike most of them), containing nothing liable to be detected in the breath, and being almost entirely free from taste or smell.

"The trial of a single bottle has invariably given muscular strength to the whole system, improving the general health, restoring energy and vigor where the constitution has been weakened by relaxation or excess; in fact, so numerous are the testimonials in its favor, that it is recommended by the Proprietor with an earnestness and confidence which the use of a single bottle will prove to be well founded."

This miserable quack—this M.P.S. by examination—dares to put forward his trash,—for aught we know, containing agents whose employment requires the most accurate medical knowledge—as capable of curing all the ailments named in the above handbill. It is well known to medical men,—who alone are qualified to treat such disorders,—that in most if not all of them it is necessary to have great regard to the constitution of the patient. Yet "communications by post will be attended to" by the "Proprietor," who also "will be happy to advise patients taking his medicines, between the hours of 10 and 10 daily."

The genius which discovered the foregoing "Infallible Restorative Mixture," did not rest satisfied with even so miraculous a production. No; his "Antecedent Lotion, which, used in accordance with the directions, is a never-failing *remedy* against infection, and consequently a safeguard against the approach of disease," is also offered to the notice of all who, in making a purchase at his shop, find their change wrapped in this man's filthy bill. The youth, whose timidity—whose fear of consequences—may deter him from incurring the risk of infection is emboldened; "Go on," says this Member by examination of the Pharmaceutical Society, "Go on, and sin; fear not!"

The fellow announces, also, in another handbill, a specific, "Dr. Thomson's Pectoral Cough Candy, prepared from a prescription of that Eminent Physician." We need not say more of this than that it is as lying a specimen of quackery as the other, stating that the candy cures every ailment of the chest and lungs.

It is high time that a stop should be put to such practices as that we now expose, and we hope that, in any measure of medical reform, or in some special enactment, the sale of secret remedies will be forbidden. It is imperatively necessary that the treatment of some of these diseases, with which, from their shameful nature, those afflicted with them do not like to acquaint their regular medical attendants — who are commonly family friends—should be placed by the legislature in the hands of properly qualified persons.

As for this person, who lives in Camden-town, we commend him to the notice of the Society; the Secretary ought to be instructed to call in his certificate of membership, or his subscription should be refused next time.

We are certain that, if the Society would at once expel all members who prostitute their profession in this abominable manner, it will receive, as it will merit, the thanks of all respectable chemists. But we have no hope of anything so useful being done.

If any officer of the Society applies to us, under authority, he shall see the bills.

THE SHORT COMINGS OF THE PHARMACEUTICAL SOCIETY.

(From a Correspondent.)

When a number of individuals associate themselves together for the professed purpose of advancing the state of some art or science, it may be presumed that they will endeavor to attain their end by one, or both, of two ways—they will assiduously collect, in order to disperse, all the facts and principles proper to their pursuit, or they will endeavor to add to the number and value of such materials by investigation and study.

The first of these functions, which amounts to no more than teaching, may be performed by any individual whose talents and position can gain him an audience; indeed, individual effort enjoys some special advantages over that of complex bodies, and, with the exception of universities, for imparting a higher kind of knowledge than money will command, this form of teaching has chiefly obtained in this country. The numerous voluntary societies which exist for the purpose of cultivating special departments of knowledge require, as their chief end, the increase rather than the dispersion of knowledge. Doubtless, many of their members help to disseminate—some by their published works, and others as professed teachers—the science which all are engaged in extending; but this is not the concern of the general body.

The plan on which the Pharmaceutical Society was established included an institution for communicating pharmacy in its most advanced state to learners by means of lectures and the instructions of professors; but we suppose it will not be asserted for a moment that, for this sole object, the chemists of England are called upon to support a cumbrous machinery, an expensive building, and a costly staff. Yet, we ask, what else is obtained at the present moment, or what, at any period within these twelve months, has been supplied by the Society in question? As a corporate body, representing a large, an educated, and what might be an influential class, it has ceased to have any significance whatever. The last retrograde step we are called upon to notice, is the utter, the despairing, abandonment by the Society of the formerly well-frequented evening monthly meetings, for the reading of papers by members of the Society. The reader must either suppose that our art has received the last finishing touch, or that its progressive character remaining, the power to assert that character has left the body in question. We do not pretend to decide; our business is now with the simple fact, that in place of the abandoned meetings, and the contributed papers, a set of pedantic Mechanics'-Institute lectures are offered.

ON THE MANUFACTURE OF ETHER.*

BY E. SOUBEIRAN.

After an operation has been the subject of attentive study in the laboratory, if, by employment in the arts, it comes to be manufactured on a large scale, it is seldom that new phenomena do not manifest themselves to those accustomed to observe these things. That which escaped the investigation of the chemist becomes more apparent, and may be the source of a modification in the quantity or quality of the products. These remarks apply particularly to the preparation of sulphuric ether. Liebig has perfectly studied the circumstances of its formation: the ether begins to form at 260° F., and its proportion increases with the temperature; but if the heat be raised too high, more or less sweet oil and sulphurous acid make their appearance. M. Boullay has taught us to pass over the etherifying mixture a continuous current of alcohol; Sottmann has rendered the operation easier, by simplifying Boullay's system. It is better still to replace the equality of the level of the liquid, which Sottmann used for regulating the flowing of the alcohol, by applying more strictly the scientific data furnished by Liebig, that is, by constantly keeping a thermometer in the still, so as to show the exact temperature throughout the operation. I now add something to these improvements by publishing a new observation on the phenomenon which constitutes etherification; it leads to a little change of the temperature at which we operate. Besides, by a new arrangement in the construction of the apparatus, I am enabled to avoid the ordinary rectification. There are two advantages—the saving of time and the avoidance of the loss of ether by evaporation, which is always very considerable, when it is necessary to rectify the products of the first distillation.

When ether is prepared in the old way—

* *Journal de Pharmacie*, Nov., 1849.

namely, by distilling a mixture of alcohol and sulphuric acid, without adding fresh alcohol to the still—the phenomena are exactly those described by Liebig. There passes into the receiver a mixture of water, alcohol, and ether, with a small quantity of the sweet oil, No gas is produced, at least unless the temperature exceeds 284° F., which is considered most favorable for etherification. It has been wrongly thought that the action remains the same when a stream of alcohol is introduced into the etherifying mixture. It is not so. In operating at 284° F., in the ordinary way, I ascertained that during the operation there is a constant and abundant disengagement of carburetted hydrogen gas. If the temperature becomes lower, the formation of gas diminishes; at 266° F. very little is formed, and its production is not continued. In an operation on a large scale, when the apparatus is terminated by a glass tube dipping a little way into water, this continual disengagement of gas is so evident that no other proof of its formation is required. However, with an apparatus of large dimensions, and which contains much air, it might be imagined that this continual disengagement is produced by the air passing out in proportion as the receivers fill with ether and as their capacity diminishes. I made an experiment which leaves no doubt on this subject; but as it was performed with the apparatus I am about to describe, I will detail it after having described the apparatus. I give the dimensions which I commonly use, leaving to every one to augment or diminish its size, according to their own requirements.

The apparatus is composed of six principal pieces:—1. A reservoir, containing the alcohol, which is to furnish the continued flow. 2. An alembic, in which is the etherifying mixture. 3. A first refrigerating rectifier. 4. A purifying vessel. 5. A refrigerating condenser. 6. A receiver for the products. The distillatory vessel is not in the same piece as the reservoir of alcohol and the condensing vessels. The receiver into which the ether is received is 5 metres distant from the furnace.

The reservoir is of tinned copper; its capacity is fifty litres. A lateral glass tube enables us to see how much alcohol remains in the reservoir; a tap regulates the flow; the alcohol descends by a leaden tube, and goes into another tap of copper, the socket of which is bifurcated, so that the alcohol is divided between two leaden tubes which convey it into the still.

The distillatory alembic is composed of a very thick copper still, 0·50 metres deep, 0·40 metres round the middle, and of the capacity of 60 litres. It is covered with a leaden head. The tubes which convey the alcohol penetrate into the still by two opposite tubulures; these tubes are of glass; they are fixed in the tubulures by means of corks covered with lute. They descend to the bottom of the still. In their upper part, they receive two leaden tubes of smaller diameter, and which dip into it for a few centimetres. The points of juncture are secured by means of a lute. These glass tubes have the great advantage of not being acted on by the acid; owing to their transparency, the alcohol may easily be seen flowing in them. We are, also, aware when it does not pass equally in both; then it may be remedied by raising or lowering one of the flexible leaden pipes.

From the tubulure of the head descends a thick copper tube to the bottom of the still. As it is rather longer than the still is high, it enters about 1 centimetre into the tubulure of the head, which is sufficient to keep it steady. This tube is pierced with three large holes, at equal distances, so that the liquors may move freely, and the vapors pass out without any difficulty. The bottom of this tube rests on a small bed of asbestos, on which is placed the bulb of a thermometer, with a long reservoir. The tube of the thermometer passes through a cork fixed in the tubulure of the head, and there marks the degrees indicating the temperature, between the limits of which etherification takes place.

The tube, which serves as a case for the thermometer, and the two glass tubes which convey the alcohol, pass through a diaphragm, formed by a thick plate of copper. It is in two pieces, whose edges lap over in such a manner that it can be put in and taken out without difficulty; it is placed at 8 centimetres from the bottom of the still. It is perforated like a skimmer, with holes, by means of an iron punch, so that the *burr* of each edge is below. The whole of this arrangement has the effect of stopping the large bubbles which are formed where the alcohol pours in, to divide them, and, consequently, to leave them longer and more effectually to the etherifying action of the acid mixture.

The retort is borne on an iron frame. The fire is kindled in a moveable furnace, which admits of the operation being relaxed or stopped at any moment. During the operation the door of the frame is kept closed. It is opened to withdraw the furnace and feed the fire.

From the alembic the vapors pass into the adopter, into the leaden tube, which, passing through a wall of separation, communi-

cates with the first refrigerating rectifier, of the capacity of 100 litres. It is fitted with a tap at the bottom, and a glass tube at the side, which shows the height of the liquid in the refrigerator. The first vapors which penetrate into this vessel condense in it, but its temperature very soon rises, and all the ether which had condensed in it is evaporated *de novo*. There then remains in the vessel only weak alcohol with a small portion of acid and sweet oil. If the temperature of this rectifier rises too high, the ether distilled over will not be sufficiently rectified. It is maintained at a proper degree by pouring tepid water on the upper surface of the vessel.

From this rectifier the ethereal vapor passes into the purifying vessel, which is made of copper and of the capacity of 30 litres. The tube which conducts the vapors pours them into a copper conduit, which descends along the inside, and which hangs in the lower part. In this part it is pierced with holes, which allow the vapors to pass out. A little above the bottom is a diaphragm, likewise perforated. Above, and throughout the capacity of the vessel, is put some small coal moistened with soap leys. To avoid accumulation of fluid in the bottom of the purifier, and a consequent pressure, which would impede the passage of the vapors, the lower tap of the purifier must be occasionally turned on. The vapor passes through the layer of charcoal, and is completely deprived of acid and sweet oil. It condenses in a worm, which is cooled by means of a constant flow of cold water.

The condensed ether flows by a tube which may be of such length as to collect the ether as far as possible from the furnace. At the *Pharmacie Centrale*, this tube is three metres long; moreover, the whole of that part of the apparatus which serves for the condensation is in the open air, so that the danger of fire is completely avoided.

The ether is received into a tinned copper vessel; a lateral glass tube enables us always to see how full it is. The ether is removed from time to time by the tap. Finally, a glass tube, from a tubulure, dips into water. It closes the apparatus and enables us to judge instantly of the disengagement of gas.

As to the progress of the operation, it is well known: I employ 15 kil. of dilute sulphuric acid at 66°, which I mix with 10 kil. of alcohol at 85°. The mixture, while quite hot, is introduced into the still by the tubulure of the head. Then the thermometer is fixed, and it is immediately heated with a very brisk fire. As soon as the temperature rises to 266° F., the tap is turned in such a manner as to cause a continuous current of alcohol of 92, a strong charcoal fire is kept under the still, and the temperature is maintained at 266° F., retarding or expediting the addition of the alcohol. By commencing the operation at 6 a.m. and concluding at 6 p.m., 120 kil. of alcohol may easily be made to pass through the acid mixture. The ether obtained is very sweet. It marks 63° of the areometer, it must be diluted with alcohol and reduced to 56°, if intended for medicinal use.

I will now state how I have placed beyond doubt the production of carburetted hydrogen gas, and determined the relative quantity of this gas formed at different temperatures.

During the progress of an operation, when I had allowed the first rectifier to accumulate a large quantity of condensed liquor, when the last receiver was also nearly full of ether, after having replaced the rectangular tube by a tube for collecting gases, I allowed the operation to proceed; but I kept the level of the liquid uniform in the two vessels, which was easy, by marking the level of the liquid with the lateral glass tubes, and turning on the taps. In this manner, the internal atmosphere did not vary in volume, and the disengagement of the gases may be appreciated with certainty. This disengagement of gas, which does not show itself in the regular distillation of the mixture of alcohol and acid, is produced by the introduction of an additional quantity of alcohol into the hot liquid. It is very difficult to explain it. It might be thought that the heat produced on contact, by the fact of the chemical action, at the moment the alcohol and acid come together, rises so high that it attains the height at which the etherifying mixture gives carburetted hydrogen and sweet oil. Without denying the possibility of this reaction, I do not, however, regard it as the real cause of the production of the gas, for the proportion of sweet oil which is formed is very trifling; it is far from being in proportion with the volume of gas produced. Perhaps the acid at this temperature may completely dishydrate the alcohol, without causing it to pass into the state of sulphovinic acid and ether. Be it as it may, it is practically advantageous not to exceed 266° F. in the etherification, otherwise a portion of the product which should be collected as ether is lost, and because carburetted hydrogen gas replaces it, and because this gas leaves the apparatus saturated with vapor of ether.

In conclusion, I will add a very curious experimental result. In an operation made with my ordinary apparatus I substituted for the mixture of alcohol and sulphuric acid 15 kil. of sulphuric acid diluted with 7½ kil.

of water, so as to form a mixture boiling at a little above 284° F.; I heated it, and when the thermometer marked 284° F. I slowly added alcohol. According to the theory of contact, of catalytic force (as we say when we wish to give an explanation which explains nothing), the etherification should take place as well, and the operation should be more economical; but nothing but alcohol distilled over. Indeed, when the operation had been continued for some time, there was a slight odor of ether: this was owing to the formation of a small quantity of sulphovinic acid, which was decomposed, giving a very small proportion of ether.

It is to be observed that, even before the formation of ether, the distillation of the alcohol was accompanied by a disengagement of gas. It is probably in the same manner that it is produced in the ordinary process of etherification. I have not carried this investigation any further, intending in this note to treat only of the practical part of the manufacture of ether.

RESEARCHES ON RHUBARB.*

BY M. GAROT.

It is known that Rhubarb root, which is employed in medicine, has been the subject of numerous experiments and of various labors, in which Vandermonde, Bernard de Jussieu, Labillardière, Bruguière, Olivier, Desfontaines, Thonin, Faujas, Leneveu, Clarion, Delunel, and Genton, have taken part. It is also known that we obtain from the plant to which this root belongs: 1. leaves (etiolate) which are eaten like chards; 2. leaves which, growing in contact with the air, furnish stems which are used as food in England, and from which, if we express the juice, we obtain, by evaporation, salt of sorrel; 3. leaves which, dried and incinerated, yield ashes very rich in alkali.

The culture of rhubarb has been attempted several times in France. Since 1765, the *Jardin du Roi* has possessed the plant which furnishes rhubarb. This plant was sent by Vandermonde.

At a later period Faujas, and afterwards Leneveu, Professor of Botany at the Military School of Strasburgh, paid attention to its cultivation. Genton cultivated from fifteen to twenty thousand plants of it. Delunel, Secretary to the Société de Pharmacie, omitted no means of propagating in France the various species of rhubarb.

Many agriculturists have devoted themselves to the cultivation of rhubarb. It is grown in large quantities at Gros Bois, near Paris, in Brittany, in Dauphiné, and at Malabry, Commune of Chatenay (Seine); there M. Mendez-Dacosta has taken all measures necessary for obtaining good results.

In 1824, the Academy of Medicine was consulted on the rhubarb obtained by M. Mendez, and it was proved that indigenous rhubarb is purgative, and that it may, without inconvenience, be substituted for foreign rhubarb; and that it is sufficient for that purpose to increase the dose by one-fourth, so that 40 grains of French rhubarb may be regarded as equivalent to 30 grains of exotic rhubarb. Clarion, when assistant chemist to the Ecole de Santé had previously proved that rhubarb grown in France might, without disadvantage, be substituted for the foreign product.

Besides these researches, unsuccessful endeavours have been made to use rhubarb in dyeing. *Rhapontic* is employed for staining leather yellow, which led Gmelin to imagine that these roots might be substituted for turmeric.

M. Garot, who has recently undertaken some researches on rhubarb, has published some facts of much interest. From his investigations it results:—

1. That by treating the various rhubarbs by nitric acid, we obtain as a residue not attacked by the acid a peculiar matter amounting to from 8 to 10 per cent. in indigenous rhubarb, and from 15 to 20 per cent. in exotic rhubarb.

2. That this matter, to which he proposes to give the name of erythrose (from the Greek verb Ερυθραινω to turn red) which is yellow when produced from indigenous rhubarb, and orange colored when obtained from exotic rhubarb, is almost entirely soluble in alcohol and in ether, which furnish, by evaporation, rhubarbaric or erythrosic acid.

3. That in combining with the alkalies, erythrose forms red or amaranth compounds, susceptible of applications in the arts and in pharmacy.

4. That erythrosate of potassa possesses, for coloring alcohol or any other non-acid fluid, a coloring power six times greater than that of cochineal, and that the rose color obtained is clearer, more vivid, and as stable.

5. That erythrosate of ammonia, after the evaporation of the excess of alkali, possesses the same properties as that of potassa, and that its coloring power is at least four times as great; that it may, moreover, be employed as red ink with as much advantage as that made with cochineal or carmine.

* *Journal de Chimie Médicale*, Dec., 1849.

6. That in perfumery this erythrosate may be used for imparting a rose color to transparent soaps, &c.

7. That the erythrosates of potassa, or ammonia of the various rhubarbs, with regard to their coloring power, must be classed in the following order:—

Muscovy rhubarb.
China rhubarb.
Indigenous rhubarb.

8. That the coloring matter of the erythrose of exotic rhubarbs being at least three times as great as that of indigenous rhubarbs, we possess in this character alone a ready means of ascertaining their origin, especially if, at the same time, the quantity of erythrose yielded by exotic and indigenous rhubarbs, as mentioned above, be taken into the calculation.

NATURAL HISTORY OF QUINQUINAS.*

BY DR. WEDDELL.

(*Continued from page* 132.)

CHEMICAL analysis has determined the relative value of the different species of quinquinas of commerce; but, it may be conceived, how important it would be to be able to recognise these species by external characters, which would dispense, to a certain extent, with the necessity for analysis. The numerous researches of quinologists, and especially those recently made by M. Guibourt, have considerably elucidated this question; but it will be understood that no one could make such an investigation with more advantage than the naturalist travellers who have gone to observe the facts at the places themselves, and who have been able to compare the barks with the branches still covered with the leaves, flowers, and fruits which characterise the species. Dr. Weddell has lately powerfully aided in this by comparing the barks which he collected, in the principal places where they grow, with those preserved in the scientific collections of Europe; and he has done so with a zeal and an intelligence which have been highly noticed, in the report recently made on his work, to the Academy of Sciences, by M. de Jussieu.

If, says Dr. Weddell, whenever a sample of bark is exhibited to us, we were acquainted with the principal features of its history, nothing would be more simple than to assign to it the place which it should occupy; it would, indeed, very naturally be placed beside the tree which produced it. But, unfortunately, this is very rarely the case; and it is for this reason that it has appeared necessary, in the first instance, to seek, in the barks themselves, the characters of their classification, erecting them into an independent group.

Every one knows the division of quinquinas into grey, yellow, orange, red, and white. I need not say that this classification is defective; the authors who have applied it are themselves struck with its inconveniences, and they have retained it, doubtless, only on account of the apparent facility of its application. Based, however, on a character so fugacious as color, it is subject, in a degree, to all the defects of artificial systems, without possessing many of their advantages. Not only does it separate the products of the same tree, but it connects others which are essentially distinct. For example, was it not formerly supposed that all the grey quinquinas were furnished by the same species? Many persons still retain this opinion. Now, not only are they produced by a very great number of species, but they are almost always only the young barks of the trees which produce the yellow and red quinquinas.

A method of classing, based on the chemical composition of the barks, would evidently be much more useful, if not more natural; and it would be, doubtless, sufficient to keep to the study of their active elements, such as quinine, cinchonine, and tannin. But the distribution which would thus be obtained, although satisfactory in theory, would not be nearly so much so in practice, as much on account of difficulties inseparable from this kind of classification as from the fact, now well proved, that the same botanical species is capable of furnishing barks which may vary in every way according to accidental circumstances.

I think, indeed, that, if a classification were absolutely necessary, one founded on the anatomical structure of the tissue of the bark would render, in the present state of science, more real service than either of the foregoing, and so much the more as we shall find a certain relation between the structural characters, and even the chemical characters of quinquina.

The following are the data which my researches have furnished on this subject:—

1. If we examine attentively a large piece of bark of *Cinchona calisaya*, as it occurs in commerce, it will be remarked that its outer side is completely deprived of peridermis, and presents broad, short, superficial furrows, which are more or less confluent* and sepa-

* *Journal de Pharmacie*, Oct., 1849.

* These furrows are nearly of the breadth of the finger, and very much resemble the

rated by projecting edges: their basis being of fibrous texture, like that of the inner side of the bark, or of the layer which is in immediate contact with the wood. The inspection of the transverse section demonstrates that the texture of this bark is homogeneous and composed of ligneous fibres of nearly equal size, uniformly distributed in an ordinary tissue gorged with resinous matters, which tissue isolates, so to speak, each fibre, by interposing in fine layers between it and the neighboring fibres. When these fibres are examined in the longitudinal section, it is observed that they are short and fusiform, with sloping extremities only loosely attached to those which are nearest to them, or even completely independent of them, and float, so to speak, in the midst of surrounding cellular tissue.

2. Take an analogous bark of *C. scrobiculata;* instead of these furrows with a fibrous base, of which I have spoken, and which characterise so well the *C. Calisaya;* there is here an almost united surface, of cellular texture, with only here and there a slight linear impression, the inner side being fibrous, as in the foregoing bark. At the transverse section, we see a greater number of fibres than in the former bark, and very close together towards the inner side, but they rapidly diminish in number towards the circumference, and the most excentric layer is quite free from them. These same fibres, examined on the surface of a longitudinal section, are of almost double the length of the fibres of *C. Calisaya*, and their extremities are constantly united with those next to them, their slope being for that purpose elongated.

3. If we study with the same attention the bark of *C. pubescens*, it will be found to possess a very peculiar structure. Its exterior surface is very similar to that of the foregoing species, with the exception of some whitish veins, formed by the persistance of portions of peridermis, and of irregular fissures which may result from the drying. The inner side is fibrous as in the foregoing barks; but its transverse section demonstrates that it is principally formed of cellular tissue, in the midst of which the fibres form only a small number of irregular and concentric series in the inner half of the bark; and what strikes at first sight is the size of these fibres, each of which is three or four times as large as in either of the varieties already described, which results from many of them being often united in fasciculi, as is perfectly demonstrated by the examination of a longitudinal section of the same bark.

As is evident, I have here supposed that quinquinas deprived of their peridermis had to be examined, because, indeed, it is generally under this form that they now occur in commerce. If they happened to be still covered with their natural envelope, this would be an additional criterion, but it would by no means invalidate the ideas I have given; for nothing can be easier than to remove this and expose the surface of the dermis to view. Be this as it may, the structure of all cinchona barks is connected more or less closely with one of the three types which I have just examined, and, as I have said, by this plan, a series of groups might be formed without much difficulty, which would contain all the known quinquinas. The object which I proposed to myself, however, in giving these particulars, has been especially to facilitate the knowledge of a very important fact in the diagnosis of different sorts of quinquinas—I allude to variations in their mode of fracture. However singular it may appear at first, it is easy to show that we may, up to a certain point, form an opinion from the fractured surface as to the chemical composition of the bark under investigation, or, to speak more clearly, there is a relation between the chemical characters of quinquinas and their anatomical characters; and the latter are always revealed by a special form of fracture; *smooth* or *suberous*, where it has divided the cellular tunic or envelope of the bark; in *short fibres, filamentous*, or *ligneous*, in cases of either of the three forms of liber described above. Now, it is a well known fact that the bark which contains the largest proportion of quinine is the *Quinquina Calisaya*, and experience has taught us that the barks which, after *Quinquina Calisaya*, contain most, are those which in structure

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impressions made by drawing the fingers irregularly over soft paste; they might be called *digital* furrows. The Spaniards call them *conchas*, on account of their resemblance to those of certain shells. They are so much the more numerous and deeper as the bark is older, and gradual exfoliation of squamæ from the surface of the liber takes place, which squamæ should be regarded as a portion of the liber itself, or still more often, as it has appeared to me, as a partial reproduction of the cellular tunic. Be this as it may, after a short existence, these plates of fibro-cellular tissue, into which the medullary rays do not penetrate, where the circulation is, doubtless, insufficient, are gorged and go to increase the thickness of the peridermis, from the side of which have already entirely passed the cellular tunic and the tubes which existed in the young plant.

most nearly resemble it; namely, those whose dermis is reduced to a single liber by the successive exfoliation of the most external tunics, or at least by their adjunction to the peridermis.

Again, experiment seems also, to a certain extent, to have demonstrated that grey quinquinas (which we have seen to be in general the young barks of other species) contain, on the average, a greater proportion of cinchonine than of quinine; we know, also, that some aged barks, which have retained the cellular tunic of their early age, likewise contain more in proportion of the latter base; whence we must conclude that quinine exists in greatest quantity in the liber, or, to speak more correctly, in the cellular tissue interposed between the fibres of the liber,* and that the cinchonine occupies more particularly that which constitutes the tunic or cellular envelope, properly so called. With regard to the tannin, it is found in greater or less proportion in the latter part than in the fibrous tunic—a fact which it is easy to determine with the fresh bark, in which the external layers of the dermis present a much higher degree of stypticity than the internal layers.

Thus, the more the surface of the transverse fracture of a quinquina approaches the suberous form, the more cinchonine it may be presumed to contain; the more, on the contrary, it approaches the short fibrous form—that is to say, of the first of the types—the more quinine should we be led to believe that it contains.

In other terms, it is so much the more probable that a quinquina will furnish a good quantity—first, as it presents a greater conformity in the texture of the different layers of its dermis; second, as the division of the fibrous elements and of the cellulo-resinous element of the liber is more equal; and finally, third, as the fibres of which this latter layer is composed are shorter and more independent of each other, whether laterally or at their extremities.

These views, whose novelty and importance cannot be disputed, are followed by details relative to the geographical distribution of the genus *Cinchona*, and which give development to the ideas which this part of quinological science owes to the labors of Humboldt and Bonpland.

(To be concluded in our next.)

* It seems that it must be concluded from this that the more abundant the cellular tissue is in the liber, the more considerable should be the quantity of quinine it contains; it is not so, however. Indeed, when the cellular tissue which is found intermixed with the cortical fibres increases beyond a certain degree, as observed in the *C. pubescens*, the liber seems then to resemble, in its properties, as in its anatomical construction, the cellular tunic. The converse of this proposition is, on the contrary, perfectly true—namely, that the more the number of fibres increases in the liber, the nearer they are together, and the less, consequently are they intermixed with cellular tissue, as in *C. scrobiculata* and *C. amydalifolia*, for example; the less, also, of quinine is found in it. The density of the fibres, themselves, is, moreover, too great to admit of the supposition that they contained a very considerable quantity of the alkaloïd.

CHEMICAL AND MICROSCOPICAL RESEARCHES ON THE BLOOD, EXCRETIONS, AND BREATH IN CHOLERA.*

BY THORNTON J. HERAPATH, ESQ.,
Mansion-house, Old Park, Bristol.

In the *London Medical Gazette* (No. 1146, for Nov. 16, 1849) Mr. T. J. Herapath gives a long and detailed account of these researches, in which he was occasionally assisted by his father, Professor W. Herapath. We wish we could insert the whole of this paper; but we must content ourselves with the following summary, with which the author concludes this very interesting memoir, referring our readers to the above-mentioned number of the excellent periodical in which it was originally published.

"Having thus in the preceding pages given a detailed account of my researches on this interesting and highly important subject, together with a description of the processes which were employed in the investigation, it would now, perhaps, be well to give a summary of my results. In the first place it will be seen, upon reference to the analyses contained under the head A, that the venous blood in cholera differs from the healthy fluid—*first*, in containing a smaller amount of serum, and a larger proportion of globules and albumen; *secondly*, in being deficient in fibrin, and the inorganic salts, more particularly in those which are present in the serum; and *thirdly and lastly*, in containing a vastly abnormal proportion of urea, uric acid, and the constituents of the bile.†

* We have to acknowledge the receipt of a reprint of this interesting paper from Mr. T. J. Herapath.

† These are merely confirmative of the

"It will also be found upon consulting the other analyses, &c.—

"4. That the rice-water evacuations, and, in fact, all the excretions in this disease, are invariably alkaline.

"5. That the alkalinity depends partly upon the presence of carbonate of ammonia, and partly, also, in the case of the dejections, upon that of the carbonates of potash and soda.

"6. That the proportion of carbonate of ammonia existing in the excretions increases in a direct ratio to the duration of the disorder.

"7. That the fæcal discharges in cholera differ from the healthy fæces, besides in the above respects, in containing a much larger comparative proportion of the soluble inorganic salts, and also of the ammonia-phosphate of magnesia, and the oxalate of lime.*

"Few and imperfect as are the observations my professional engagements have permitted me to make, still every one that is at all acquainted with chemical analysis will readily perceive that they were no mean undertaking for a single individual. They are, indeed, the result of many months' close application. Should they, however, furnish us with only one new fact which will assist us in arriving at a more correct comprehension of the nature of this horrible malady than we at present possess, I shall consider my exertions to have been amply repaid, and the time and trouble that has been expended upon them to have been far from misspent. It was not my original intention to publish these results in so incomplete a form: I had determined to re-investigate several points upon which I entertained some doubts. I have, however, been prevented from doing so from the want of a subject to operate upon, not a single case of true Asiatic cholera having occurred in this city during the whole of the last week. It is, therefore, extremely probable that I shall be compelled to wait patiently until the following spring, when, should this unwelcome visitor again make its appearance amongst us, I have fully resolved to again direct my attention to the subject.

"Before concluding this paper I ought, perhaps, to give my opinion relative to the theory of the fungoid origin of cholera which has been lately propounded by Drs. Brittan and Swayne, and has attracted so much attention. That certain peculiarly-formed bodies, similar in appearance to those which have been described by the above-mentioned gentlemen, are really present in the cholera dejections and vomited matters, it would now be preposterous to doubt, for I have not only repeatedly seen them with my own eyes (having been induced to look for them at the suggestion of Dr. Brittan), but the fact has been also established beyond all dispute by the results of every experimenter who has employed a lens of sufficiently high power for their detection. What the nature of these bodies may be, however, whether they be cells or not, I think it would as yet be premature of any one to say. For although they appear to possess many of the outward characters of a cellular organism, still their behaviour with reagents would, in my opinion, go far to disprove this supposition. In the first place, by the admission of each of their discoveries, they are both hard and brittle, and possess none of the elasticity usually observed in cellular structures. Then, again, they are not in the least affected either by boiling, or by digestion in strong acetic acid, as we should naturally imagine cells would be. Neither are they acted upon to any great extent by concentrated nitric or hydrochloric acid, with the exception, perhaps, of being rendered somewhat more transparent. The only agent, indeed, of those I have myself tried, that would appear to have any effect upon them, is concentrated sulphuric acid: this partly decomposes and disintegrates them; it does not, however, do so entirely, for even after more than a quarter of an hour's digestion in that menstruum, small fragments of the external annulus still remained untouched.

"It must not be imagined, however, that, because I admit the presence of these 'annular bodies' in the matters above specified, I must, therefore, agree with Drs. Budd and Brittan relative to their constant occurrence in the air and water of infected neighbourhoods; for although I have repeatedly searched for them in those situations, I have never, even in one instance, met with the slightest success, notwithstanding the operations were conducted with the greatest circumspection, and an apparatus employed which was nearly, if not quite, similar to the one adopted by Dr. Brittan. As it is very

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results of previous experimenters: Lecanu, O'Shaughnessy, Simon, and Heller, all arrived at similar conclusions. Wittstock, however, could not detect any urea in cholera blood.

* It is more than probable that the oxalic acid of this salt is produced from the uric acid of the blood in the same manner as the carbonate of ammonia must be formed from the urea, by oxidation. If this were admitted to be the case we could readily account for the absence of uric acid and urate of ammonia in the evacuations in this disease, and likewise for the occurrence of oxalate of lime in the exhalations from the skin.

possible that some doubts may be hereafter cast upon the accuracy of my results, I think it will be advisable to give the particulars of my mode of operating. My apparatus for the examination of the atmosphere consisted of a small caoutchouc single-valved bellows, capable of containing about a quarter of a cubic foot. To the lower orifice of this there was adapted a glass tube previously bent into the form of a triangle, and furnished with three bulbs; the middle one, and smallest of these bulbs, was then filled with a few drops of water. When, therefore, the bellows was in action, all the air which entered through the lower valve, and was afterwards forced out of the jet, was compelled to pass through the water contained in the triangle. By this arrangement it was conceived that, if the supposed organisms did really occur in the air, even in the most minute proportion, they would necessarily be collected in increased quantity in the few drops of water, and be thus rendered capable of detection by the microscope. Notwithstanding, however, that several dozen cubic feet of air from some of the worst neighbourhoods in Bristol were thus passed through the apparatus, no trace of the 'cholera cells' could be discovered. In this way I have examined, with negative results, first, the atmosphere of the wards of the Cholera Hospital in Peter-street; secondly, that of a chamber of a house situated in a court in Lewin's Mead, where two children had been attacked with Asiatic cholera in its most virulent form, and died the same day, and where two other younger children, brother and sister to the former, were still lying with symptoms of choleraic diarrhœa; and, thirdly, the atmosphere of a house in Temple-street, at a period when the disease was rife there, two persons having been removed from the chamber on the same day to the Cholera Hospital.

"I have also examined a specimen of the identical water which had been drunk by the children who afterwards died in Lewin's Mead, and also another specimen of the same liquid from the court in Temple-street, but in both instances with a similar want of success. In these cases I may observe that the water was concentrated by heat, or by spontaneous evaporation over sulphuric acid, previously to its microscopical examination. By these means the contents of several thousand grains of the water were condensed into the bulk of a few drops: still not one single cell could be discovered, although in both experiments a great number of inorganic particles of all sizes were observed, many of which bore some resemblance in form to the 'cholera cells' previously mentioned. The inorganic character, however, of these particles was undoubted, and could be readily proved by their remaining intact after exposure to a red heat. It would, therefore, be as well if Dr. Budd would state more distinctly his mode of procedure, as it is barely possible that the presence of these inorganic bodies may have caused him to arrive at an erroneous conclusion.

"Now, if any dependence is to be placed upon the facts just related, it is clear that the ingenious theories of Drs. Budd and Swayne, which would attribute the origin of this epidemic to the presence of these organisms in the water and atmosphere, must be considered to be completely overturned; for if it is possible to be proved indisputably, only in one instance, that a case of cholera may occur at the same time that these cells are absent both from the water and from the air, it is evident that we must look in some other direction for the *fons et origo mali*; or, at all events, if they are truly the cause of the disease, then they must be capable of entering into the human organism by some other means than we are at present acquainted with.

"However this may be, the subject is one which well deserves further investigation; and I hope that my fellow-laborers in this field of research, who are more happily, or rather unhappily, circumstanced with respect to patients than myself, will do everything in their power either to confirm or disprove my experiments."

POISONING BY THE BERRIES OF THE DAPHNE MEZEREON.*

Dr. Schwebe mentions, in *Casper's Wochenschrift*, the case of two children, one four, the other two years of age, who ate berries of the mezereon whilst playing in a garden. The eldest child soon complained of a burning sensation in the mouth, and nausea. He confessed having swallowed the berries, and was made to reject some of them by the administration of milk. Some of the vomited berries were masticated, and others quite whole. He, however, continued to complain of dryness in the throat, and a burning at the pit of the stomach; a reddish mucus was discharged from the mouth, and he had nausea without vomiting, with a regular pulse. The little girl, two years of age, did not seem at all unwell, although she also had eaten berries. They both now had an emetic, and the little girl vomited eight whole berries. In spite of this, both chil-

* *Lancet*, Dec. 15.

dren were plunged in a complete narcotism an hour afterwards, with coma, convulsive movements of the eyes and superior extremities, dilatation and insensibility of the pupils. Warm baths, cold affusions on the head, sinapisms to the lower limbs, &c., removed these symptoms. The next day the two children were quite well. It will be perceived that the fruit of the daphne mezerion produces narcotico-acrid effects, and that the means used for this kind of poisoning will be the most advisable when these berries have been accidentally swallowed.

OCCLUSIVE DRESSING OF BURNS.*

M. Chassaignac, of Paris, has a peculiar way of dressing burns, which resembles, in some degree, Baynton's strapping. The French surgeon applies to the burned surface a kind of shield, made of straps of adhesive plaster, carefully prepared and imbricated; this is covered by fenestrated lint, spread with cerate, and the whole secured by compressors and rollers. When suppuration is abundant the lint only is changed, but the shield not interfered with; the latter is strengthened by additional straps, if at all giving way, and the exterior of it washed with spirit lotion, or water mixed with lime juice. The apparatus should be removed, from the eighth to the tenth day, by the aid of a director and scissors gliding along its groove.

ICE IN OPHTHALMIA.†

Our readers are aware that M. Chassaignac, of Paris, treats infantile purulent ophthalmia by cold water douching. This gentleman has lately advised, in the *Gazette des Hôpitaux*, the use of ice in various kinds of severe ophthalmia. A great number of affections of the eye have been thus treated, ranging from the ophthalmia which succeeds operations for cataract and external violence, to hypopium and the most intense inflammations of the cornea. The author has arrived at the conclusion that the apparatus of vision is the one which illustrates, in the highest degree, the power of continuous applications of ice. M. Chassaignac does not, however, advocate the exclusive use of the ice, and advises the ordinary therapeutic means to be combined with it. It is applied by means of a kind of orbital mask of wire-work, secured by a spring, the pad of which presses on the occiput. The mask is composed of two layers, between which little bags of ice are introduced.

* *Lancet*, *Dec.* 15th, 1849.
† *Lancet*, *Dec.* 15th, 1849.

DECOMPOSITION OF BELLADONNA JUICE.*

At a recent meeting of the Liverpool Chemists' Association, Mr. H. S. Evans described a curious decomposition, accompanied by the disengagement of red vapors, which had occurred in some expressed juice of Atropa belladonna. The juice, after having been pressed from the plant, was put into casks and bunged down, with the view of keeping it for a few days, until its conversion into extract could be proceeded with. On opening the casks the bungs were projected with considerable force, and the red fumes alluded to, resembling nitrous acid, issued from the casks. Some of the gas was collected in bottles, and was found to be soluble in water, and to redden litmus paper.

ON SEMENCONTRA: A NEW MODE OF ADMINISTERING IT TO INFANTS.†

BY M. AUG. GAFFARD, OF AURILLAC.

Semencontra is, as every one knows, an excellent vermifuge, having a specific action on the worms (ascarides, oxyures, &c.) which attack infants in particular, and, consequently, of frequent employment in the verminous affections of infancy. But, although often employed, it would be much more so if it could be easily administered as often as its employment is indicated; indeed, its bitterness renders it repulsive to most children, and all the pains bestowed on disguising it with saccharine matters do not generally suffice to render it agreeable enough for children of delicate taste. Impressed with the necessity for rendering its administration possible in these cases, I have sought the means of accomplishing it, and, I am happy to say, with the most complete success. I make pastilles of it, which, although possessing in a high degree the vermifuge properties of semencontra, have little or none of its unpleasant taste. M. Calloud, in proposing a mode of extracting santonine, and putting pharmaceutical chemists in the way of obtaining this principle, seemed to have attained this object, since santonine, administered in the form of pills, is a medicament at once agreeable to the taste and possessing the vermifuge properties of semencontra. Unfortunately, santonine, prepared according to the directions of this skilful pharmacien, is too expensive for the lower orders, whose children seem to be more particularly subject to worms. It was,

* *Pharm. Journ.*, *Dec.* 1849.
† *Journal de Pharmacie du Midi.*

therefore, desirable to find a substance which, having the advantages of santonine, might be sold at a moderate price—an advantage which my product possesses over that of M. Calloud.

The high price of santonine is easily accounted for: besides that semencontra contains very little of it, its extraction is tedious, and requires care and expensive menstrua; in this treatment other, not inferior, vermifuge principles are neglected. Now, among the latter are many which, like santonine, have very little taste, and present the same advantages. The knowledge of these proximate principles, the power of obtaining them at the same time as the santonine by a simple and economical process, and a formula for their use, were the objects of my investigation. I will pass over the details of my experiments, and give their principal results.

Semencontra is composed, as is already known, of—1, a soluble bitter principle; 2, a complex resinous matter of greenish-brown color; 3, essential oil; 4, santonine; 5, other principles of little importance, such as ligneous matter, gum, ulmine, salts of lime, silica, &c. Bouillon-Lagrange thought that the volatile oil was the active principle of semencontra. M. Calloud noticed the vermifuge property of santonine. My father ascertained, in his medical practice, that all the proximate principles of semencontra, except the ligneous matter and those abovenamed after it, were possessed of the same therapeutical properties as the essential oil and santonine. One of them, the soluble bitter principle, has a very powerful taste; the resin and essential oil have a rather bitter taste, but rendered bearable, like that of santonine, by the addition of sugar. But the three active principles with little taste—the santonine, resin, and volatile oil—are of a fatty nature, and sufficiently electro-negative to be saponified by a powerful base, and it is of this property that I have availed myself to eliminate them together from the other principles of semencontra, and to obtain a product which I substitute for pure santonine for medical use. Until a better name be proposed, we may call this complex product brown, or impure, santonine.

Mode of obtaining brown santonine:—

Semencontra of Aleppo	100
Salt of tartar	30
Slaked and sifted lime.....	15
Water.....	3 to 4 pints.

Put the whole on a fire in a basin, stir occasionally with a wooden spatula, and boil for about an hour. Strain through a cloth, with pressure; allow the liquid to settle; decant; filter the residue, after having added to it a small quantity of water; mix the decanted and filtered liquids, and decompose with hydrochloric or nitric acid, taking care not to employ a great excess of acid (until the liquid powerfully reddens litmus without tasting very sour). Allow it to settle; filter it through paper previously moistened, or, better still, if a large quantity be acted on, through a cloth or flannel previously wetted. Dry in the open air, and keep it in bottles for use. This product—a mixture of resin, santonine, and essential oil—may be regarded as sufficiently dry when it has obtained the consistence of butter of *muscade*. If the desiccation were carried further, a portion of the essential oil would be lost. When this happens, it is known by the change of color of the surface, which bleaches, as well as by the formation of a hard superficial layer.

Pastilles of Brown Santonine.

Brown santonine..	12 grammes.
Powdered sugar ..	430 ,,
Powdered gum ..	50 ,,
Essential oil of citron or bergamotte	25 drops.

Pour the essential oil on the sugar; put the brown santonine into a marble mortar; add, by degrees, and while triturating the sugar and gum, so as to form a homogeneous powder, and make, with a sufficient quantity of water, a mass of the consistence necessary for making the lozenges, which you should make of the weight of 1·15 gr. Every lozenge which, dried, will weigh about 1 gramme (15·434 grains English), and will contain 0·025 of vermifuge principle.

If we color the mixture of the powder in the mortar with confectioners' carmine, and if we use for powdering the lozenges, sugar previously reddened with the same carmine, we obtain lozenges which, without deriving any bad taste from the addition, will be of a rose color, which pleases the children, and renders them of a more engaging appearance to them.

Those physicians of our acquaintance, who have long prescribed these pastilles, order them in the doses and manner following:—

Under 6 months	1, night and morning.
From 6 to 12 months..	2, ,,
From 1 to 2 years....	3, ,,
From 2 to 4 years....	4, ,,

From 5 years and upwards, as many pastilles, night and morning, as the child is years old.

This treatment is continued for two days and more, until no further results are obtained.

FORSTER'S PATENT FILTER.

Messrs. Parkes and Co., of Chancery-lane, Dublin, have called our attention to this excellent filter, for which they are agents in Dublin. It consists of a cylindrical vessel, of Derbyshire sandstone, of considerable thickness; this stone cylinder is placed in the vessel containing the water which it is desired to filter, and the water, leaving the impurities behind, finds its way through the pores of the stone into the interior of the cylinder, from which it may be drawn off by means of a pipe from its lower extremity, air being admitted by means of a pipe from its upper surface. The advantages of this filter are very considerable. Among the chief of these we may rank its portability, and its capability of filtering from 8 gallons to 50,000 gallons and upwards per day.

It would be a good thing to compel landlords to supply a filter of this construction to every house, and considering that the expense would seldom exceed 2*l*., we think that they could not complain if forced by the Legislature to adopt it.

For manufacturing purposes, in which water free from impurities, separable by filtration is required, this filter will be found invaluable, the flow of water is very rapid, a cylinder of the capacity of 8 gallons filling in ten minutes, and larger ones in proportionately less time.

The coolness of the water drawn from the interior of this stone is very refreshing.

It must be invaluable on board ships, and we are given to understand that it is extensively used in the Royal Navy.

Pharmaceutical chemists will find it invaluable to them, and we strongly recommend it to all who are not already possessed of it.

CURE OF HYDROPHOBIA.*

M. Rocher D'Héricourt, who has lately returned from a journey in Abyssinia, has brought with him manuscripts of great literary value, and has collected many facts calculated to throw light on geology, mineralogy, botany, and other branches of science. He has, likewise, brought with him numerous specimens of a plant, the root of which, reduced to powder, is a cure for hydrophobia—both in men and animals. Of its virtues, M. D'Héricourt had practical proofs. Three dogs and a man having been bitten by a mad dog, they were, by the application of this remedy, cured of the hydrophobia which ensued; whilst a fourth dog (bitten, at the same time, by the same animal), to which the remedy was not applied, perished in all the agony of that terrible disease. The virtue of the plant, and the manner of preparing it for use, were explained to the traveller by a potentate of the country, who assured him that it was there generally used, and never failed. The specimens brought over by M. D'Héricourt have been submitted to the Academy of Sciences of Paris, and a committee has been appointed to test their efficacy.

* *Lancet*, Dec. 8th, 1849.

CHEMICAL INVESTIGATIONS OF CHOLERA EVACUATIONS.*

Dr. Becquerel has published, in the "Archives de Médicine," for October, 1849, various analyses of the blood and evacuations of cholera patients. The results obtained agree, on the whole, with those published on the same subject by Dr. Garrod and Dr. Parkes, viz., considerable density of the whole mass of the blood, and particularly of the serum; increase in weight both of extractive matter, of the various salts, particularly of the fatty matter; and the preservation, or rather diminution, of the proportion of pure albumen in the serum of the blood. But Dr. Becquerel has especially pointed out the increase of fatty particles; and Dr. Garrod the rather large proportion of urea in the blood of cholera patients. The editor of the "Archives" notices, however, a slight difference between Dr. Becquerel and Dr. Garrod's results, as regards pure albumen; the former stating that it is preserved or diminished; the latter, that it is augmented, though, he adds, that the cases have been too few to give any importance to this difference. As to the alvine evacuations, we find that Dr. Becquerel and Dr. Parkes agree pretty well. They both look on these evacuations as composed of slightly albuminous water, neutral or faintly alkaline, containing, besides the albumen in solution, a variable quantity of coagulated albumen, united to a small amount of mucous, and a relatively large quantity of chloride of sodium. But the analyses of these two physicians differ herein, that Dr. Parkes looks upon the flaky matter of the dejections, the cells, dark yellow granules, and amorphous matter, as fibrin, or modifications of that substance; whilst Dr. Becquerel considers these bodies as coagulated albumen. Our contemporary likewise thinks Dr. Gardner in error, when he maintains, in his article on the pathological anatomy of cholera, published in the "Monthly Journal," that the above-named bodies are mucous.

* *Lancet*, Dec. 8th, 1849.

ANSWER TO "ALPHA" ON LIEBIG.

To the Editors of the Chemist.

GENTLEMEN,

How the risible faculties of all those at all interested in science must have been excited at the answer given to my strictures on a provincial toxicologist, in your last valuable journal, and signed "*Alpha!*" The article (by a certain teacher to an Infirmary at Liverpool) shows so much arrogance that I wonder you allowed it space, for it really disfigures your columns. The presumption of any man putting the following question!—"Is not Liebig equally fallible with Brett?" You, gentlemen, know, as well as I do, that Professor Liebig is acknowledged to be the greatest chemical authority in the world. Will any one have the goodness to point out to me *any eminent chemist* that ever quoted Liverpool's toxicologist as an authority? And, in my wanderings throughout Europe, I must candidly confess I never met a chemist of any note who knew there was such a man in existence. I would compare Dr. Brett's fallibility with a chemist of a year's standing, and I cannot be far wrong in stating this when one of the most accurate and best chemists in London writes the following upon him:—"I am much surprised that Brett, in the face of such positive analytical evidence, should state the grossest absurdity. It is folly, and waste of valuable time, to disprove what such a man may assert. You have already seen what pretensions he has to chemistry by his incorrect analysis, and, therefore, I think it useless to oppose him. With respect to the action of the salts of mercury, lead, and arsenious acid on animal matters, I satisfied myself years ago; I found them all capable of rendering albumen insoluble, and also of forming indefinite chemical compounds with it." Why does Dr. Brett now run down Liebig, when, in the year 1842, he published, in the "Liverpool Mercury," some letters "On the Chemical Principles involved in Vegetation, and the Agency of Manures," all the views in which are palpably taken from Liebig's "Agriculture," and in which occurs the passage—"It is the opinion of that distinguished chemist, Liebig," &c., &c.

I candidly believe that the Liverpool College of Chemistry has made Brett an enemy to Liebig, for all the intricate analyses are sent there, and consequently there must be a great falling off in the income of Liverpool's once famous analyst. Does Dr. Brett get any analysis from the homœopathic druggists of Liverpool? for I see in a catalogue issued by Thomas Thompson and Son, the following extraordinary announcement:—"Thomas Thompson and Son have completed an arrangement with Dr. Brett for the performance of analysis either qualitative or quantitative. Dr. Brett's skill as an analyst is too well known (?) to require further comment. Anything left for analysis at 12, Church-street, will meet with prompt attention." Let the above speak for itself. "Alpha" gave a quotation from Berzelius in his reply to me. Why did he not append Liebig's annihilating answer?* I would suggest to Dr. Brett the following:—Go for three years and study chemistry at Giessen, and be particular during the time to learn how to make organic analyses; then return to your home a promising pupil of the German school. If you are afraid of the language and the sea voyage, why attend for the same space of time at the Royal College of Chemistry in London, and you will never regret this wholesome advice. I should very much like to know under whom you did study.

Your obliged correspondent,
A FRIEND OF LIEBIG.

SWINBORNE'S PATENT GELATINE.

We have been favored by Mr. G. P. Swinborne, of Great Tower-street, London, with samples of gelatine and isinglass, prepared by his patent process, which we have submitted to examination, and can add our testimony to their purity; and, such being the case, we deem it our duty to call public attention to them, feeling confident that they will meet the approbation of those who try them. The following quotation from a report signed by Professor Brande and Mr. J. T. Cooper, will be a sufficient proof of what we have stated, and save the necessity of repeating the mode of examination which we applied to them:—"We have carefully analysed and examined the different articles, both isinglass and gelatine, manufactured by them. We compared their Patent Refined Isinglass with Russian Isinglass of the first quality; we find the former in all respects superior; it is perfectly free from color, taste, and smell; it makes a clear solution in hot water, leaves no deposit, and contains no insoluble matter. The jelly is stronger, firmer, and more durable than that prepared with the same proportion of Russian Isinglass, two parts of the one being equal to three parts of the other; the patent article, therefore, may be economically and advantageously substituted for the best Russian or other isinglass.

"We have also compared the relative weights of the precipitates for media solutions of tannin, by similar quantities of each

* See *The Lancet* for June 22, 1844.

article, and find them in the same proportion of 110 to 112, hence we conclude that the former is the stronger, more concentrated, and perfect form of isinglass.

"The gelatine is well adapted as a strengthener for soups and other nutritive forms of food, and as both it and the isinglass are dry substances, their nutritive powers stand high when compared with fresh meat, which contains three-fourths its weight of moisture."

TO CORRESPONDENTS.

In reply to several correspondents, who have written us on the subject of the Ferricitras cum quina, we have to inform them that we *have* seen Mr. Barnes's letter in the *Pharmaceutical Journal*. As we stated in our last number, the use of ammonia is inadmissible to precipitate the quina: the precipitate redissolves in the water requisite for washing the precipitate. It is a great pity that incorrect statements upon such subjects should get into print. We hope our readers will take care that they are not defrauded in purchasing this article; there is bad in the market.

"W. Tozier."—1st. There is no authorised formula for the compound mentioned. The iodine, iron turnings, and water should be mixed first, and the other articles not added until combination is effected, which is aided by the application of a moderate heat at first. The sugar is added to preserve, as far as possible, the iodide as a proto-compound. The change of color is owing to the formation of periodide, which takes place with great rapidity. It should be preserved in a dark place in well closed vessels; as a hydrate should be dried at a very moderate heat, otherwise it becomes resinous. 2nd. The oil acts simply as a solvent; the addition might be useful under some circumstances, but not universally so. Such compounds with other oils have been tried as a substitute, but do not appear to produce any very good results. The natural compound, the peculiar action of which is not precisely understood, has in practice many advantages.

In answer to the correspondent who writes to us about Dr. Clarke's method of purifying water, we beg to say that it only ensures the removal of that portion of the lime contained in the water as carbonate dissolved in carbonic acid. The "hardness" of ordinary water depends upon the existence of sulphate of lime in the water, as well as carbonate, upon which the solution of lime employed by Dr. C. would be without action. It is a curious fact that the sulphate of lime should be overlooked by these water purifiers. Sulphate of lime is more soluble, under ordinary circumstances, than the carbonate, and more troublesome. Other salts will confer the property of "hardness" upon water besides those named. Insoluble compounds are formed, composed of the fatty matter in combination with the base of the compound which originally existed in the water.

"A Constant Reader."—If you will favor us with your address, we will write you by post.

"T. W."—For galvanic meter, read galvanometer; it was a mistake in the print. The battery would probably be more powerful if arranged as you mention. Daniel's arrangement is for ordinary purposes the most convenient, and can be fitted up at a very trifling cost; the electricity developed has greater intensity and the current is much more regular.

"J. W."—Bisulphite of lime is formed by passing an excess of sulphurous acid into a mixture of lime and water, occasionally stirring during the passage of the gas.

"Thos. Naylor."—We are very glad to hear from our old correspondent again.—1st. Sturge, Birmingham. 2nd. The coil is wound one layer over another and not bent back, the secondary coil the same. The primary coil is sometimes cut into lengths, so as not to interpose so long a conductor. 3rd. It depends upon circumstances too numerous to mention properly here; by ordinary arrangements there is a simple substitution of intensity for quantity, the latter is more especially required for the production of magnetic force. 4th. About 32s. per lb. We shall be happy to receive the communications alluded to. If you require any further information upon the above subjects, write again.

"Z."—Bicarbonate of Potassa.

"L. H. K."—Refer to No. 1 of the new series and you will find what you want.

"An Amateur," "L. H. (Kent)," "J. B. N.," "A Chemical Manufacturer," and "A Student," will be answered in our next, or by post.

Anonymous correspondents must send their names *in confidence*.

Errata in No. III.—In Mr. Deck's paper, page 112, col. 2, line 19, for Cu Si read 2 Cu O, Sb O^5. Page 111, cols. 1 and 2, for Gluirine read Glairine.

Notice.—*All Communications and Books for Review must be addressed* "To the Publisher of The Chemist, 17, Surrey-street, Strand, London." *Communications must be pre-paid, and sent before the 15th of each month. Books for Review before the 10th,*

THE CHEMIST.

[NEW SERIES.]

I. CHEMISTRY.

ANALYSIS OF THE WELL-WATER OF THE ROYAL MINT, WITH SOME REMARKS ON THE WATERS OF THE LONDON WELLS.*

BY WILLIAM THOMAS BRANDE, F.R.S., V.P.C.S.

PREVIOUS to the year 1844 the Mint was supplied with water principally from two sources: the dwelling-houses, offices, and part of the works by the New River Company, and the steam-engines by wells partly supplied by so-called land-springs, and partly by a tunnel communicating with the Tower moat, the principal supplies being derived from the latter; so that when, in consequence of any works carrying on at the Tower, the access of the river to the moat was impeded, the operations of the Mint were not unfrequently obliged to be suspended; besides which, the water derived from that source was always muddy, and sometimes very foul and offensive.

In consequence of this bad condition of the water in the Tower moat, and the effluvia arising from it in hot weather, it was resolved, in the year 1843, to drain and lay it dry. The Mint was accordingly altogether deprived of the supply of water from that source, and the land-springs supplying the wells of the steam-engines, to say nothing of the impurity and hardness of the water thence derived, were found wholly inadequate to the wants of the engines. It, therefore, became necessary to have recourse to the New River Company for such additional supplies of water as might be wanted for carrying on the business of the Mint; and for this their charges, as far as the steam-engines were concerned, were at the rate of £10 per horse power per annum; but, from various causes, these supplies could not always be depended on, so that, on several occasions, a temporary suspension of the business of the Mint was the consequence of a deficient supply of water.

Under these circumstances, it became my duty to suggest to the Master of the Mint the adoption of such measures as might ensure for the future a regular and adequate supply of water for the use of the whole establishment; and to this end it was necessary, in the first instance, to make myself accurately acquainted with the actual condition of the several wells existing in the Mint, and with the quantity and quality of the water which might be derived from them. I was, therefore, authorised by the Master of the Mint, to consult with Mr. Thomas Clark, an experienced well engineer, with reference to the subject, and accordingly desired him to examine into the condition and capabilities of all the wells, shafts, and tunnels connected with the supplies of water throughout the building. The examination was carefully and effectually accomplished; and it appeared that the several wells were in a very dilapidated and, some of them, in a very dangerous state; that few of them were situated, or conditioned, so as to admit of being sufficiently safely deepened, so as to yield an adequate supply of water; and that, as respected the wells in the several engine-houses, they were mere reservoirs connected with the tunnel-shaft from the Tower, and, therefore, almost exclusively supplied from the muddy source of the Tower moat.

Having personally convinced myself of the correctness of the report, and having had Mr. Clark's statement corroborated by Mr. George Rennie, I represented the matter in detail to the Master of the Mint, and sug-

* *Journal of the Chemical Society.*

gested three plans for consideration, namely, 1. To derive the requisite supplies of water from the water companies. 2. To repair the present wells, and to deepen such of them as would admit of that operation. 3. To sink an entirely new well; and I strongly urged the adoption of the latter alternative, which, after due consideration, was agreed to. I, therefore, obtained proper plans and estimates from Mr. Clark, which, after having been submitted to the Board of Works, and, by their direction, to Major Jebb, were ultimately ordered to be carried into execution.

These plans included the sinking of an entirely new well, the erection of a capacious water-tank at a sufficient height to supply the ordinary demands of the Mint; proper pumps for raising the water, and mains for distributing it over all parts of the buildings, together with fire-cocks and other arrangements, the details of which would be irrelevant to the object of this communication.

It may be right to premise that the total depth of this new well is about 426 feet, that the depth from the surface down to the chalk is about 224, and the borings into the chalk about 202 feet; the following being the well-sinker's account of the strata gone through, namely—

	Feet.
Made earth	11
Gravel and sand (with water)	13
Blue clay, with a few sandy veins (no water)	98
Colored sand, and pebbles (abundance of water)	14
Dark sand, with veins of clay (little water)	4
Mottled clay (dry)	6
Loamy sand, and dark clay (little water)	5
Blue clay, with shells	6
White rock (quite dry)	3
Green sandy rock, and pebbles (dry)	3
Loamy green sand, and black pebbles (little water)	5
Green sand, and pebbles (abundance of water)	6
Dark sand, with shells	40
Flints	10
Chalk	202
	426

The lining of the upper part of the well, through the gravel, and into the blue clay, is composed of stout cast-iron cylinders, 14 inches thick, and 8 feet clear diameter, and jointed with strong bolts and nuts; these prevent all access of the land-springs from above; the shaft is then steined to the depth of 88 feet (that is, nearly through the blue clay), in quick-cemented brickwork; after which, cast-iron cylinders are resumed, of 7 feet diameter, and these are continued down to the chalk; but, after passing through the stratum of mottled clay, they include a series of cylinders of 6 feet diameter, the space between the outer and inner cylinders being filled with gravel pebbles; a bore-pipe, 20 inches diameter, and 45 feet long, is then driven to about 10 feet into the chalk, and through this the boring is continued, by an 8-inch auger, to the entire depth of the well.

This well, and all the works connected with it, were completed at Christmas, 1846; and on the 1st January, 1847, the whole of the works of the Mint, and of the dwelling-houses, were supplied with the water, which is raised in a 6-inch main to a height of 50 feet above the surface, or 130 feet above the average level of the water in the well; and is delivered at the rate of 140 gallons per minute, by means of three pumps of 9-inch diameter and 8-inch stroke, into a tank supported upon a building of brickwork. This tank is 100 feet long, 30 wide, and 5 deep; it contains, therefore, 15,000 cubic feet of water, or 93,750 imperial gallons. Two 6-inch cast-iron mains, furnished with proper slide valves, descend from this tank, one passing on either side of the Mint, so as conveniently to supply the whole of the establishment: the daily consumption of water frequently exceeding 40,000 gallons; besides which, a daily supply of about 6,000 gallons is delivered, by means of a main laid from the Mint across Tower Hill to the Tower, for the use of the inhabitants and the garrison; there being at present no serviceable wells in that fortress, and the water derived from the adjacent river being objectionable in point of cleanliness.

The average height which the water obtains in the shaft of the Mint well is 80 feet from the surface. After a day's pumping it is lowered, upon an average, 20 feet; but there it remains stationary, the flow of water from below maintaining the level; or, in other words, delivering at the rate of 240 gallons per minute.

Before this well was completed, and before the boring into the chalk had been accomplished, the water derived from it contained 44 grains of dry saline matter in the imperial gallon. At present the machinery being complete, and the well in full and daily use, the mean of several experiments, in reference to the solid matter contained in the imperial gallon of the water, amounts to 37·5 grains.

The substances contained in each gallon of the water are as follow:—

Sulphuric acid	7·44
Chlorine	6·31
Carbonic acid (after boiling)	5·84
Silica	0·50
Sodium, combined with chlorine	4·22
Soda (combined with sulphuric and carbonic acids)	10·82
Lime	1·92
Magnesia	0·72
Organic matter, Phosphoric acid, Iron	traces.

The water evaporated to one half of its bulk, and, filtered, had lost almost every trace of lime and of magnesia, so that it is probable that the greater part of those substances were held in the state of carbonates, by excess of carbonic acid. The carbonate of lime forms films during boiling, which subside, and appear under the microscope in the form of very minute circular crystals. The crystalline deposit obtained by slowly evaporating the water after the precipitated carbonate of lime has been separated by filtration, exhibits, under the microscope, three distinct forms; namely, cubes (of chloride of sodium); prisms, which lie distinct upon the other salts, and are efflorescent (sulphate of soda); and small aggregates of rhomboids intermixed with small spherical particles, like pin-heads (carbonate of soda.) The residue of the evaporation of the water, after having been gradually raised to a dull red heat, acquired a grey tint, and exhaled a slight odor of burning azotised matter; and a piece of moistened turmeric paper held in the evolved vapor was transitorily reddened.

I have not been able to detect any potassa in this water; and only a slight indication of the presence of a phosphate, in the precipitate deposited by the water during boiling.

Upon the whole, I am inclined to regard the following as a tolerably correct statement of the proximate saline components of this water:—

	Grains in the imp. gal.
Chloride of sodium	10·53
Sulphate of soda	13·14
Carbonate of soda	8·63
Carbonate of lime	3·50
Carbonate of magnesia	1·50
Silica	0·50
Organic matter, Iron, Phosphoric acid	traces.
	37·80

The specific gravity of the water at 55° is 10·007. Its gaseous contents I have not ascertained.

I have the water of several other wells in and about London, some of which derive their supplies from the sands under the blue clay; and others, to a greater or less extent, also from borings into the chalk, and I think that, in most cases, the latter waters are the more pure; that is, that in proportion as the borings are deepened into the chalk, the less are the solid contents of the water. There are in London and its vicinity some very deep wells which yet do not reach the chalk; and others, of a less depth, which are carried into it, arising out of inequalities in the surface of the chalk, and the varying thickness of the blue clay itself; so that the variations in the relative quantity of solid matter in the waters derived from these wells, is no criterion of their respective depths.*

The shallow wells of the London district, by which I mean those which do not penetrate the blue clay, but derive their supplies from the gravels and sands above it, yield water of varying quality, but always much less pure than that of the deeper wells, and generally abounding in sulphate of lime, and consequently eminently hard, as respects the decomposition of soap, and other common culinary uses.

There are many of these wells in which analysis detects indications of contamination by sewers, and by the vicinity of gas pipes; and some of them have been disused and filled up on that account. There are, also, as is well known, many which are in churchyards, or upon their boundaries, and it is from these parish pumps, that the neighborhood often exclusively derives its supply of drinking water. I am at present examining the waters of several of these wells. In those which I have already examined, I have been struck with the abundance of nitrates, generally nitrate of lime; and this, in some of them, is accompanied by what may be termed a large proportion of organic matter; so large, indeed, that on proceeding in one case to heat the dry residue of the water to redness, a deflagration ensued, and yet this

* The chief peculiarity of these waters is derived from the presence of carbonate of soda, which, notwithstanding the large relative proportion of other salts which they often contain, confers upon them a peculiar softness, as regards the soap test, and seems to render them well adapted for domestic use, and especially for the infusion of tea and coffee.

water is bright and colorless, has no unpleasant taste, and is abundantly resorted to as very superior spring water by a very populous neighborhood.

How far such waters may, or may not, be salubrious, is not the question here to be discussed; but in some cases there can, I suppose, be no doubt upon the subject, inasmuch as I have found two of these waters of an evident, though slight, brown or peaty tinge as furnished from the well, soon becoming brown on evaporation, and yielding abundant evidence of containing that species of humic extractive in which the adjacent soil, no doubt, abounds. I have in no instance been able to detect ammoniacal salts in any of these waters, but I presume that the nitric acid which they contain is the result of the oxidisement of ammonia.

It was my wish to have laid some of the results of these analyses more in detail before the Society—my apology for such imperfect details is the hope that they may engage the attention of other analysts; that the important subject of the condition of the waters of London and its vicinity may meet with the attention it deserves, and that the comprehensive subject of the metropolitan supply of water may be scientifically, accurately, and dispassionately considered by those who are adequate to the task.

As regards the leading question of river supplies on the one hand, and artesian supplies on the other, I cannot, however, help expressing myself decidedly in favor of the former. Deep wells are pre-eminently valuable for local uses; but the peculiarities of the waters which they afford, the depth from which, in many situations and under most circumstances, those waters must be raised; the possibility, and, I think I may say, probability of the inadequacy of their supply, and the chances of their mutual interference are some of the circumstances which in my mind should be well weighed, before the gigantic scheme of the supply of the metropolis from such sources is seriously entertained.

On the other hand, pure river water is already upon the surface, in various quarters, in unlimited quantity, and at no great distance; and when filtered, an operation which, as experience has shown, is attainable to any extent, its quality is in all respects superior. That many parts of London are badly and inefficiently supplied with water, and that in some places none is laid on, cannot be denied; but a slight movement in a proper direction would, I think, remedy all real evils under this head. I must further beg leave to express my opinion in favor of the adequacy of the existing water companies to the accomplishment of all that can be reasonably required: the magnitude of their united means, the general excellence of their arrangements, the practical skill with which they have been devised and executed, and the resources which are still open to them when increase of supply is demanded, are the circumstances under which I found this opinion.

I shall conclude with a short comparative table, showing the relative quantity of solid matter contained in such river and spring waters as have been carefully analysed, intending upon a future occasion to extend the list; to give the details of the analyses and the names of the analysts; in their present imperfect state, however, the following details will serve to illustrate some of the points touched upon in the preceding notice. The wells which are termed deep derive their water from the strata below the blue clay, and some of them penetrate into the chalk; those termed shallow were supplied from the strata above the blue clay. This is the case with most of the common London wells, which, however, are often sunk to a considerable depth in the clay for the purpose of forming a reservoir.

	Solid matter in the imp. gal.
Thames at Greenwich	27·9
,, London	28·0
,, Westminster	24·4
,, Brentford	19·2
,, Twickenham	22·4
,, Teddington	17·4
Average of the Thames between Teddington and Greenwich	23·2
New River	19·2
Colne	21·3
Lea	23·7
Ravensborne at Deptford	20·0
Combe and Delafield's Brewery, Long-acre ... Deep well	56·8
Apothecaries' Hall, Blackfriars.. Do.	45·0
Notting-hill ... Do.	60·6
Royal Mint ... Do.	37·8
Hampstead Water Works ... Do.	40·4
Berkeley-square ... Do.	60·0
Tilbury Fort ... Do.	75·9
Goding's Brewery, Lambeth.. Do.	50·0
Ditto ... Shallow well	110·0
More's Brewery, Old-st.. Deep well	38·0
Ditto ... Shallow well	110·0
Trafalgar-sq. Fountains.. Deep well	68·9
Well in St. Paul's Church-yard....	75·0
,, Bream's-buildings	115·0
,, St. Giles's, Holborn	105·0
,, St. Martin's, Charing-cross	95·0
,, Postern-row, Tower	88·0
Artesian well at Grenelle, near Paris	9·86

ON THE FUSION AND VOLATILISATION OF BODIES.*

BY M. DESPRETZ.

I. During last winter I entertained the audience of the Course of Physics of the Sorbonne with some experiments prepared to exhibit to it a very powerful focus of heat; but the feeble intensity of the sun at that period of the year, prevented me from completely realising the experiments. I resumed these experiments at the commencement of the present month (June, 1849).

The three most powerful sources of heat are the sun, the electric current, and combustion. It is natural to seek to unite these three sources of heat, in order to extend the effects hitherto observed. This idea must have presented itself to the mind of more than one experimentalist.

I do not occupy myself, in this note, with ascertaining in what proportion the temperature changes at a point at which three different sources of heat are collected; I seek only a more energetic practical process for producing the fusion or volatilisation of bodies than is at present known.

I have employed, for the time, a Bunsen's battery of 120 pairs, constructed by M. Deleuil (the zinc in the centre). I united with this battery 45 pairs of another Bunsen's battery, constructed by M. Archereau (the charcoal in the centre). This battery, which M. Soleil was kind enough to lend me, was of rather larger dimensions than the foregoing, and might be equivalent to about 65 pairs. Thus the whole battery represented 185 pairs of ordinary dimensions, the height of the zinc equal to about 13 centimetres (5·11823 inches).

The annular lens was nearly 90 centimetres (about a yard) in diameter.

The blowpipe was used with hydrogen. I substituted for this gas carburetted hydrogen, charged or not charged with essence, to render the heat more intense. The following are some of the results obtained:—

The power of the battery is increased by the addition of another source of heat; thus hard and compact magnesia, which, under the action of the battery alone, became pasty, immediately volatilised in the form of white vapor by the concurrent action of the battery and the lens. This single experiment shows well the efficacy of the process.

I prepared acicular rods with very pure anthracite, given to me by M. Delafosse. One of these rods, of about 1 millimetre (0·03937 inches) in diameter, and 3 centim. (1¼ inch) in length, soon subjected to the double action of the battery and the lens.

Another rod, subjected to the simultaneous action of the battery, the lens, and the blowpipe, appeared to fuse. Two persons present with me at the experiment, and myself separately, thought that the anthracite fell in drops.

In another experiment similar to the foregoing, I found, in a platinum capsule, placed under the anthracite rod, some small black globules, visible with the naked eye. Several persons have likewise seen them: I should say that they were black like anthracite.

These are the only results worthy of notice at present obtained in these experiments.

The three sources of heat appear to me well adapted for determining the fusion or volatilisation of bodies already oxidised, or which burn difficultly in contact with the air; but for charcoal it is better to operate only with the battery and the lens in vacuo or in nitrogen gas, replacing the blowpipe with a certain number of voltaïc elements. I will shortly try this. I am convinced, from my experiments, that very thin rods of anthracite or pure sugar charcoal, properly prepared, would completely fuse in it. In the air, very thin rods are very rapidly dissipated; larger rods resist the action of the air, but they do not become sufficiently heated to enter into fusion.

I hope also, through the kindness of the professors in Paris, to be able to collect 4 or 500 Bunsen's elements. (*Comptes Rendus*, June 18, 1849.)

II. Although I have made a very great number of experiments since the sitting of the 18th of June, when I had the honor of communicating to the Academy the results obtained by the concurrent action of the three most powerful sources of heat, I shall to-day confine myself to relating a particular result, which appears to me interesting. This is the reduction of carbon into vapor.

In the various experiments which I have made, I have obtained evident proofs of the fusion of charcoal. This is not only my opinion, but that of all who have witnessed the experiments. But, on the present occasion, I will speak only of the volatilisation of this substance.

Seeing that the greater part of the charcoal disappeared in the air under the triple

* M. Despretz has made to the Academy of Sciences four communications on this subject, which are inserted in the *Comptes Rendus* for June 18, July 16, Nov. 19, and Dec. 17. 1849. As the entire collection is too bulky for insertion in one number of this periodical, we are compelled to divide it into several. The importance of the subject, and the high authority of M. Despretz induce us to insert his earliest communication.—Eds. Chemist.

action of light, the battery, and the blowpipe, and not yet being possessed of apparatus with which I could operate secure from the presence of oxygen, I endeavored to collect a great number of Bunsen's elements. Thanks to the kindness of my brethren and colleagues, I have been able to collect 500 elements. Having ascertained, by experiment, that a flat zinc element has the same intensity as a cylindrical one, I replaced with new flat elements all the zinc elements lent to me, which I should very soon have deteriorated. I should mention that M. Pouillet and M. Fourcault have already employed flat zinc elements, and M. Archereau prismatic charcoal elements.

I wished to see what the battery alone would produce. For that purpose I combined 496 elements in four parallel series. This was about equivalent to 124 elements of four times the size. I placed in the apparatus, called the *electrical egg*, a rod of sugar charcoal, of about 4 millimetres (0·15748 inch), and about 5 centimetres (about 2 inches) long, between the two poles. I made the vacuum at nearly 5 millimetres (0·19685 inch), and I established the communication. The charcoal was carried to a high degree of incandescence, and the glass was covered with a black, dry, crystalline powder. I feared that the cement had run. I wiped the glass; the cement remained intact. Besides, it was on the outside especially that it would be perceived if it were heated to the fusing point. It was not even softened. A little of the fatty matter of the leather box might have been the cause of the phenomenon. Although the interior stem was dry and clean, I reversed the apparatus in such a manner as to put the leather box below, always leaving the positive pole above. I recommenced the experiment, and I obtained the same result.

I also repeated the experiment with the apparatus which now serves for exhibiting the electric light at the lectures. This apparatus is much longer than the foregoing, but it is too narrow. When the charcoal which was fixed to the positive pole was used up on the side nearest to the negative pole, it became of a dazzling white; there were deposited on the sides of the vessel some white streaks, then suddenly it was reduced to vapor, with something of the appearance presented when iodine is thrown on a sufficiently hot body. All that part of the apparatus nearest to the focus was covered with a black, dry, crystalline powder. The glass broke. The experiment was repeated twice with the same result.

This experiment was also made in a very large crystal bell glass, separated in the interior of the focus by wire gauze. A brilliant layer of charcoal in powder was deposited on the upper part of the lateral partition, as in the three preceding experiments.

Several people have seen these experiments, and have been convinced, like myself, that the carbon was volatilised. This cannot be an illusion caused by the volatilisation of a small quantity of the fatty matter of the leather box.

M. Archereau has often made the experiment of the electrical light for whole hours together; he has never observed anything like this, although the ferrules were heated much more on account of the long duration of his experiments. Each of our experiments lasted one or two minutes, then the current was interrupted. The ferrules were scarcely heated at all. M. Deleuil has frequently made, at Sorbonne and elsewhere, the experiment with the two charcoals, but the phenomenon which I notice has never presented itself to him.

In the experiments of M. Archereau, M. Deleuil, and others, 60, 80, or 100 elements of ordinary dimensions were employed. In these conditions nothing can be observed, for if we take, as I have done, 124, 248, 372, and 496, in a series of 124, it is seen that the charcoal becomes more and more brilliant; but it is only when the four series are collected that the volatilisation commences and is accomplished. Even if the battery had been charged with acid for a few days, the reduction of the charcoal to vapor might not take place.

Sugar charcoal was first made in a covered crucible, then mixed intimately with about one-third of sugar, and kept in pistol barrels, at the temperature of a large reverberatory furnace, for four or five hours. No organic matter could remain in it, as it must have been decomposed at the increasing temperature produced by 124, 248, and 372 elements; volatilisation begins only at the temperature of the current of 496 elements. Besides, an organic matter gives more or less acid vapors, the deposit is dry; when put into distilled water it does not redden litmus paper. Finally, the charcoal of the retorts gives rise to the same phenomenon, and in the same circumstances. Here the presence of the slightest traces of organic matter is not to be suspected, owing to the origin of this charcoal. It is to be remarked, that the phenomenon is more striking with this kind of charcoal than with sugar charcoal. The volatilisation takes place instantaneously, probably on account of a higher temperature which a more powerful cohesion requires. It is known that retort charcoal has a very great density.

It is, therefore, easier to volatilise charcoal than to fuse it into rather large globules. Will it be the same with borax and silicium? Experiment alone can decide the question; I shall endeavor to do it.

Charcoal acts nearly like lime, magnesia, oxide of zinc, &c., taken in the pure state, which, according to my experiments, are more easily volatilised than fused. I have, however, reduced them to transparent glasses. Albumen, rutile, anastase, nigrine, oxide of iron, disthene, &c., are immediately obtained in globules, and then give vapors.

All our experiments have shown us that neither in the air nor *in vacuo* must we try to obtain charcoal fused into rather large globules, but in nitrogen, at a pressure superior to that of the atmosphere. Vessels of glass or crystal are not adapted for this kind of investigation; they almost always break. It is absolutely necessary to operate in metallic vessels. I will hasten to present to the Academy the additional results I shall arrive at, if I find them worthy of attention.

I think that from this time I may draw from my experiments, even with the means in my power, and I hope to increase them, the deduction that all bodies are fusible and volatile.—(*Comptes Rendus*, No. 3, July 16th, 1849.)

III. I extract from the register of my experiments on the fusion and volatilisation of bodies a note relative to silicium, boron, titanium, tungsten, palladium, and platinum.

The silicium which I subjected to the action of the electrical fire was fused with facility; it immediately collected into a globule, rather vitreous on the surface. In some points, the fracture of this silicium, reduced into a globule, is dull, differing little from that of charcoal; in others, it resembles the vitreous fracture of certain anthracites. By rubbing with emery powder, this surface may acquire the polish of a very deep black glass. The color of silicium in powder has not completely disappeared, or remains on a portion of the surface. This silicium, thus fused, scratches glass. It ought not to have contained silicic acid. It had been treated a great number of times with hydrofluoric acid.

This silicium was obtained by M. Laroque, formerly preparator of the School of Pharmacy, by means of Berzelius' process. It possessed the characters assigned to it by the Swedish chemist: color, nut brown: infusible, and incombustible, at a high temperature.

Boron.—A portion of the boron which I employed was prepared by M. Robiquet, son of our late excellent colleague; another portion was prepared by M. Laroque. The two products furnished the same results, although they differed much in appearance. M. Robiquet's boron was as black as lamp black; M. Larogue's was brownish. The chemists who have studied boron know that this substance does not always occur of the same color.

Boron fuses, at the first application of heat, into a globule, also slightly vitreous on its surface. The fracture is granular, black, and very much resembling that of charcoal. It is more fusible and more volatile than silicium.

The boron is not very hard.

These experiments on silicium and boron were made in nitrogen.

Titanium.—This metal, in a brownish powder, had been prepared by MM. Rousseau, for the Exposition of Industry; they extracted it from chloride of titanium.

In a primary experiment in the vacuum of the pneumatic machine, it volatilised in great quantity, and deposited partly on the porcelain capsule fixed over the crucible, in the form of a pellicle of a reddish brown, with a metallic lustre. There remained a small plate of a yellowish white, in the crucible of sugar charcoal, in which the powder of titanium had been placed.

In another experiment, made in nitrogen, the porcelain capsule was covered with a layer of a beautiful blue. There remained in the crucible a whitish plate, beneath which the sides of the crucible were covered with small globules—some of a golden yellow, others iridescent of various colors.

The blue deposit was probably only oxide of titanium already existing in the second titanium which we treated, or else produced by a small quantity of air which might have been introduced, without our knowledge, under the large bell glass in which the experiment was carried on.

The plates and globules, on being cut, showed the true color of titanium, which is a rather pale golden yellow; the fracture and the cut portion not polished were of a greenish yellow. It is probable that the red color attributed to titanium is the result of a slight oxidation.

It is softer than tungsten, which scratches it, but it is very hard; it scratches quartz and zircon, and it is very nearly as hard as corindon.

Tungsten.—This metal was fused, like titanium, boron, and silicium, in a crucible made of sugar charcoal, under a bell glass filled with nitrogen.

There condensed on the porcelain capsule, arranged as already described, a thin brownish layer. On the sides of the crucible were

found two small plates of a greyish white. In another experiment, the metal fused at first into a unique globule, then it diffused itself over the sides of the crucible.

This metal takes a fine polish; the fracture is that of fine-tempered steel, with a slight granulation. It is very hard; it wears out files; it scratches quartz, the precious stones, and even the natural or artificial ruby. We speak here of plain surfaces, for the curved and crystalline surface of the globules of alumina, containing only a small portion of oxide of chrome, is not cut.

M. Gaudin, known to the Academy by several important investigations, has been kind enough to undertake to polish some hard bodies which I have fused. He has obtained polished facets, even on rubies, by means of emery powder and powder of alumina; but for tungsten he was obliged to have recourse to diamond dust.

Would it not be possible to turn this great hardness of tungsten to account in the arts? For example, might not tools for turning the precious stones and pens for cutting glass be made of this metal?

If, without diminishing the hardness of tungsten, its solidity, which is scarcely equal to that of cast-iron, could be increased by the presence of a quantity of iron or steel to be fixed by experiment, we should have a product capable of replacing the precious stones in certain instruments of precision. We know already, from a work of the Duc de Luynes, that a small quantity of tungsten, united with steel, produces a damascus of fine quality. Probably alloys of inverse proportion must be obtained.

In these experiments I employed 600 Bunsen's elements, united in six series.

The battery presented to me a convenient process for fusing the metals without adding foreign substances. There is not a single metal which resists the electric fire.

I fused 80 grammes of palladium prepared by Mr. Phillips; the metal was immediately reduced to a beautiful button. This button was laminated, and presented great ductility and perfect homogeneousness. I would have fused a greater quantity of palladium if I had had more at my disposal.

It appears to me also that the battery might be turned to account for fusing platinum clippings. I fused in a few minutes 250 grammes of platinum belonging to M. Demontis. I could, perhaps, have fused twice or three times as much, if I had had larger charcoal crucibles. I hope to be able to effect this in a few days. If we operate on a few grammes of the metal, a considerable quantity of it may be volatilised. I have covered with it porcelain capsules of 1 decimetre (3·93708 inches) in diameter; but a mass of several hundred grammes does not become sufficiently heated to diminish sensibly in weight in a very short time.

I am disposed to think that we have here a new application of the battery to the industrial arts. The necessity for redissolving the platinum clippings would be avoided, &c. They would be immediately obtained in a button. I now only wish to call the attention of the Academy to the fact of the fusion of platinum by the voltaïc battery, in sufficient quantity to give rise to an improvement in the working of that metal. I feel that a comparison must be made of this fused platinum and the platinum obtained in the large way. I will give the results of this comparison in an early communication.—(*Comptes Rendus*, Nov. 19, 1849).

RESEARCHES ON THE ASSOCIATION OF SILVER WITH METALLIC MINERALS, AND ON THE PROCESSES TO BE FOLLOWED FOR ITS EXTRACTION.

BY MM. MALAGUTI AND DUROCHER.

In a former abstract of our investigations which we had the honor of presenting to the Academy, on the 26th of July, 1847, we showed that silver is found associated with many metallic sulphurets in which its presence was not suspected; we have extended our investigations to other metallic minerals, and we are now in a condition to affirm that they almost all contain silver, even when they do not come from beds from which that metal is extracted. Thus, in more than two hundred substances which we have examined, it is only in one-twentieth of the assays that we failed to find silver. Many, indeed, have presented only traces, and very often it would have been uncertain had we not modified the modes of assay generally followed. We, at once, proved that the humid way is entirely inapplicable in such researches; then we prepared litharge almost entirely free from silver, and we also tested the purity of the fluxes and other reagents which we required to use. Afterwards, we determined the conditions in which the fusions should be executed, in order to render the losses as small as possible, and we ascertained that bractese of silver, weighing one-sixteenth (English) of a milligramme, will not disappear in cupellation, even when alloyed with 30 grammes of lead.

* *Comptes Rendus*, Nos. 24, 10th Dec., and 25, 17th Dec., 1849.

In experiments which we made on the roasting of various sulphurets, we were struck with seeing that the silver contained in the blendes may suffer, by sublimation, a loss of more than half. In certain circumstances this metal volatilises much more easily than is supposed; it forms incrustations on the sides of the apparatus employed in the operation. It is the same with the silver sublimed in roasting galena; and that furnishes the explanation of an important metallurgical fact, namely, that, notwithstanding the precaution of collecting the pulverulent *cadmies* in the condensing chambers, there are always very considerable losses in silver, which adheres, as our experiments show, on the sides of the conduits, in such a manner that it cannot be detached.

Silver is unequally distributed in the various metallic compounds; thus, the oxides and saline compounds are always poorer than the sulphurets, and among the latter the compounds with iron for a radical are generally less rich in silver than those of lead, copper, and zinc. These remarks on the unequal distribution of silver in natural substances are, moreover, confirmed by what occurs in operations by the dry way, executed in the laboratory or in metallurgical establishments.

The universal diffusion of silver in the mineral kingdom leads us to think that other metals are, perhaps, as much diffused in nature: this is known to be the case as regards iron. We have been led to examine, in this point of view, crystallised minerals presenting all the characters of purity. We have assayed twelve samples of galena, and in all we have detected, independent of silver, very sensible quantities of iron, copper, and zinc.

To ascertain the state in which the silver is associated in small quantity in various metallic minerals, and especially with the sulphurets, sulpho-arseniurets, and sulpho-antimoniurets, we tried various reagents which were thought to be capable of reacting on metallic silver, and not on its sulphuret, especially when the latter is in combination with sulphurets of other metals. The employment of liquid chlorine, of bichloride of copper, and of persulphate of iron, did not give us very positive results; mercury furnished us more precise indications: of 38 samples treated, several of which were very rich, only 11 yielded to the mercury a portion of their precious metal. The comparison, with the results deduced from experiments made in similar conditions on substances, into which were introduced, in different manners, metallic silver or sulphuret of silver, enabled us to conclude that, probably, silver does not exist in the same form in all the sulphurets containing small quantities of that metal; but that, most frequently, it appears to be combined in the state of sulphuret with the substance which it accompanies.

Moreover, we have completed our former experiments, by demonstrating that the metallic sulphurets cannot contain silver in the state of chloride or bromide; and we have observed some remarkable re-actions which are produced between the chlorides and the sulphurets. We divide the latter into three groups:—

1. Bimolecular sulphurets, such as those of zinc, cadmium, lead, &c.

2. Sulphurets possessing more than one molecule of sulphur, and capable of abandoning some of it—the bisulphuret of tin for example.

3. The sulphurets not saturated with sulphur and capable of absorbing it, such as the proto-sulphuret of copper.

The first re-act on chloride of silver by double decomposition; the second undergo a partial reduction, and are converted into proto-sulphuret; the third partially reduce chloride of silver, and also act on it by double decomposition. The arseniurets, sulpho-arseniurets and sulpho-antimoniurets, placed in the same circumstances, produce on chloride of silver an action similar to that which the sulphurets produce.

These various bodies were put in contact with chloride of silver dissolved in ammonia and sometimes in hyposulphite of soda; but we have proved that the presence of the solvent produces no other effect than accelerating the phenomenon, rendering its observation more convenient, but it does not alter its essential conditions.

It is remarkable that the decomposition produced by the sulphurets, arseniurets, &c., is often as clear and as complete as if we operated on bodies dissolved in water. Thus, we quote, as examples, native sulphuret of copper, arseniuret of antimony, arsenical cobalt, arsenical nickel, &c. Certain sulphurets, which, however, are not very numerous, are almost without action; such are, for example, the sulphuret of mercury and grey cobalt, which, in that respect, differ much from grey nickel.* Metallic iron is

*Among other curious facts, we may here mention the iridescence which may be communicated to copper pyrites by putting it in contact with chloride of silver: colored copper may thus be artificially produced, not inferior in the richness of its tints to native-colored copper.

comparable to it in this respect, for it does not precipitate, or only very slightly, silver in solution, under the form of concentrated ammoniacal chloride, and even under the form of nitrate.

The power of the sulphurets of decomposing chloride of silver is generally better developed in those which act by way of reduction than in those which produce a double decomposition; besides, this power appears to be in relation with the electro-chemical state of the metals. It must also be added that the various minerals belonging to the same species present decomposing faculties which vary in the ratio of their differences of composition, crystalline form, density, and cohesion.

Bromide of silver, put in contact with metallic sulphurets, presents the same phenomena of decomposition as the chloride. In short, all these facts appear to depend on a general law of reaction of sulphurets on chlorides of insoluble on soluble salts. Besides, we have proved that these reactions are produced by the dry way as well as by the humid way: thus galena decomposes chloride of silver in fusion; we have seen blende arrest the vapor of this chloride, and convert it into sulphuret of silver. The same vapor is also decomposed, with the aid of heat, by quartz, feldspath, argil, and silicates in general.

The reactions of sulphurets on the chlorides, which we have seen produced in such different conditions, have an evident character of generality, and the observation of metalliferous beds presents a new confirmation of it; for the chloride and bromide of silver are not found in the midst of the metallic sulphurets, but in the upper parts of the lodes, which have been altered and oxidised under the influence of external causes. We also deduce from our experiments the explanation of certain geological phenomena; for example, of the concentration which the native silver and sulphuret of silver ore of the lodes of Königsberg has undergone, which ore is found agglomerated in contact with schistous bands, impregnated with various metallic sulphurets, iron and copper pyrites, blende, and galena.

Notwithstanding the labors of several men of science on the amalgamation of silver ores, there are, in the theory of the various processes, obscure points or contested reactions; besides, these processes, especially the American method, present imperfections which it is desirable to remedy.

The numerous experiments which we have performed may throw some light on these difficult questions. Without entering into details, we will give the general results which we have obtained. We at once proved that the gangues which accompany silver ores perform a more important part than has been supposed; the *fat* or argilaceous gangues are the worst, and the best are the quartzy gangues, or, in general, the lean gangues, that is to say, those which have least tendency to form a paste with water. The proportion of water which is added must also be taken into consideration: the most proper is that which suffices for bringing to the state of a semi-liquid paste the matter which is submitted to amalgamation; besides, these results agree with practical observations.

We have also studied the chemical influence which certain gangues may exert, as, for instance, carbonate of lime, which, in peculiar circumstances, may impede the chloridation of the silver. A similar obstacle may result from the presence of foreign metallic sulphurets, of zinc, lead, &c., as may be foreseen from our preceding experiments on the reciprocal action of chloride of silver and the sulphurets. On the other hand, the presence of various salts favors the reduction of chloride of silver; common salt is of the number; nevertheless, an excess of this solvent is more injurious than useful.

In almost all the processes of amalgamation, the first operation consists in changing the sulphuret of silver, and even metallic silver, into chloride, by either the dry or the humid way; however, this chloride must afterwards be reduced, and then there is a risk of a considerable loss of mercury, for this metal acts, not only on the chloride of silver, but also on the remaining portion of the chloridising agents which have been introduced. To account for the method universally followed, we have demonstrated, by a series of comparative experiments, that if we confine ourselves to the employment of mercury alone, the silver, in the state of chloride, amalgamates more slowly than when it is in the metallic form, or even that of sulphuret; but, in other circumstances, the contrary is the case, if, for example, metallic iron be added; this iron, with the aid of electro-chemical currents, operates a rapid reduction of the chloride of silver, and the precious metal is accordingly absorbed by the mercury.

Be it as it may, the employment of the American method is very slow, for the chloridation of the native silver and sulphuret of silver requires considerable time, especially when the sulphuret of silver is associated with other metallic sulphurets.* Very often,

* Silver, in the state of sulphuret or sulpho-arseniuret, is converted into chloride by

indeed, the silver unites with the chlorine only when almost the whole of the metals which accompany it has been chloruised. This inconvenience is immense, for, independently of the slowness inherent to this process, the conversion of the silver is often incomplete, and there may result considerable losses, in consequence of the abandonment of the imperfectly exhausted residues.

These considerations led us to seek a process in which the sulphuret of silver would be directly reduced without converting the metal into chloride, and thus avoiding the principal cause of the loss of mercury, which is so considerable in American establishments. We found that several re-agents are capable of reducing sulphuret of silver, alone or combined with other sulphurets; we tried, for this purpose, several metals, and we observed, as an accessory fact, that hydrogen, in the nascent state and cold, is itself capable of reducing several sulphurets. However, the re-agent which we regard as most efficacious is metallic copper, employed at the temperature of boiling water, and accompanied by certain salts, sulphate of copper or iron, or alum. The results which we have obtained, in experimenting on argentiferous sulphurets of all kinds, have appeared to us sufficiently important to merit the consideration of the workers of silver mines; they open a new field for researches to the industry of that metal.

We have also made some experiments on a process which has recently been put in practice, and the principle of which is to dissolve the chloride of silver in a concentrated solution of common salt; we have ascertained that, by this method, abstraction being made of practical difficulties, and especially of filtration in the large way, we may exhaust, almost completely, the chloridised ores, or those susceptible of chloridisation. This method presents, besides, as compared with amalgamation, the advantage of avoiding the employment of mercury, a very costly re-agent, and of very limited production. If the application of this method became general, the production of silver might be greatly increased.

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contact with bichloride of copper, depositing sulphur, if we operate out of contact with the air, and sulphuric acid being formed in the contrary case. It is incorrectly supposed that the presence of common salt is necessary for the occurrence of this reaction, but its sole effect is to increase its rapidity.

STUDIES OF ORGANIC CHEMISTRY DIRECTED TO PHYSIOLOGICAL AND MEDICAL APPLICATIONS.*

BY M. E. MILLON.

In former communications, MM. Regnault and Reiset made known how we had conceived together a system of experiments calculated to introduce accurate explanations into the chemical study of respiration, nutrition, and animal heat. The pneumatic part of these phenomena was treated by my two colleagues, who have already published their results; I devoted myself, in this necessary division, to analysing the fluids and solids which the animal economy absorbs or eliminates.

The elementary organic analysis presents very serious obstacles when it is applied to the soft or liquid matters which compose the aliments and products of secretion. In the first place, their desiccation, which is considered necessary prior to combustion, is not always practicable; in most cases, it is extremely slow and delicate: finally, evaporation even in a sand bath may produce a loss of matter, of which no account has hitherto been taken. There is some urine, the evaporation of which, managed with the greatest care, dissipates half of the combined nitrogen. I decided on attempting the direct analysis of soft or liquid organic matters, without previous evaporation or desiccation. Unquestionably, organic analysis has been brought to an admirable degree of perfection of late years; but this high degree of perfection has been attained only by reason of the precise and circumscribed conditions in which we operate. To mix with oxide of copper 5, 10, 15, and even 20 grammes of liquid, instead of a few dicigrammes of dry matter, to determine the dimensions and substance suitable for this mixture, and to condense accurately a quantity of water proportional to this enormous quantity of liquid introduced, is to attack the whole economy of organic analysis.

Without minutely describing the experiments which I have made, I have pointed out in my work the arrangements on which I decided for the construction of the grate; the preparation of the oxide of copper, for the choice of combustion tubes; the mixture of the oxide with the substance, and, finally, the fitting up of the various pieces of each apparatus. All the vegetable and animal substances to which this metal has been applied have furnished, whatever their degree of consistence or of dilution, a more rapid

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* *Comptes Rendus*, 2e Semestre, 1849, No. 21.

and more easy determination of carbon, hydrogen, and nitrogen.

The knowledge of the elementary composition of the blood, chyle, urine, bile, of all animal tissues, and of all the parts of plants, by accurate and simplified means of analysis, will certainly present peculiar resources to physiological studies. Being especially occupied in finding the method and ascertaining the principles of execution, I have not carried any application of it to such or such problem of vitality. However, the only analyses of the blood, chyle, urine, and some alimentary substances, which I have executed in determinate conditions, will show the benefit which may be derived from this method.

At present, I confine myself to noting some facts relative to nutrition. I hoped to enter, as easily as the observers who have preceded me, into the knowledge of the variations which affect one or other of the organic elements of the economy—as nitrogen, for example; but, following the ordinary process, I multiplied, as much as possible, the analyses serving as proof and counter proof. I selected the rabbit as the subject of experiment, on account of its very varied regimen, and because its size admits of its introduction into the respiratory apparatus constructed by MM. Regnault and Reiset.

For a fixed period of ten days the rabbit was fed exclusively on cabbage. The analysis, repeated on the green parts and on the white parts of the leaf of the cabbage, gave the following results:—

Very bulky round cabbage.	In 1,000 grms., Grms. of nitgn.
Green part, undried	5·5
White part	6·2
Green and white parts mixed	5·6
Green part (very young cabbage)	4·2

The estimation of nitrogen in the dried leaf still further augmented the divergences in the proportion of this element.

It was difficult to deduce from such numbers an average of nitrogen consumed. Nevertheless, as this experiment was commenced with the desire of arriving at more positive results, I rendered it complete by the accurate weighing of the cabbage administered daily, as well as by the analysis of the excrements and urine.

The urine collected at two different times, and representing each a period of two days, furnished:—

	Grms. of nitgn.
1st period. In 1,000 grammes of urine	6·0
2nd period. In 1,000 grammes of urine	4·9

These two numbers are still so different that is impossible to adopt either of them to represent the nitrogen of the urinary secretion. I do not know whether it would be more accurate to take the mean of the two.

As to the nitrogen of the excrements, it was identical in two analyses made two days apart, 14·3 grammes of nitrogen in 1,000 grammes of undried matter; and I must declare, that the proportion of nitrogen varies little in the undried excrements of the same rabbit; notwithstanding their degree of consistence, and notwithstanding various aliments, there is very little difference between one rabbit and another. As the rabbit experimented on was evidently tired of the cabbage, for some days bread and carrots were given to it, which it ate very greedily; then, for thirteen days, it was fed with carrots alone. The carrots were analysed; but here the variations are much greater, and different parts of the same root contain very unequal proportions of nitrogen; this may be judged of from the following numbers:—

	Grms of nitgn.
Cortical portion, in 1,000 grammes	1·60
Central portion, in 1,000 grammes	0·96
Point of the carrot, in 1,000 grammes	0·92
Another cortical portion, in 1,000 grammes	1·50
Another cortical portion, in 1,000 grammes	0·41
New carrot, entire	1·99

Passing on to the analysis of the urine, I found, for three periods of two days each—

	Grms of nitgn.
1st period. In 1,000 grammes of urine	1·70
2nd period. In 1,000 grammes of urine	1·60
3rd period. In 1,000 grammes of urine	0·80

I was not more fortunate in this second experiment on nutrition than in the first; however, as I could attribute the enormous variations of the urinary secretion to the bad influence of a single aliment, I subject the same rabbit to a mixed regimen of cabbage, carrots, and bread; the mixture of these three substances suited it well. It again became very active, and very lively; gained 100 grammes in weight in nine days, and continued to receive these three aliments, but in rather less quantity, and in such a manner as to increase only 20 grammes during the eight days following. It was in these last eight days that the urine was analysed, in three periods of two days each—

	Grms of nitgn.
1st period. In 1,000 grammes of urine	2·60
2nd period. In 1,000 grammes of urine	5·24
3rd period. In 1,000 grammes of urine	3·01

This last experiment at length showed me what I ought to think of the fixity of secretions in conditions most favorable to their regulation.

Doubtless it would have been more simple to admit, in the foregoing experiments, that

in the course of a sufficiently prolonged uniform regimen, all the animal functions are maintained in a state of perfect equilibrium, and to restrict oneself to a single analysis of the carrot or of the cabbage than of the excrements and urine representing a period of two, three, or four days; but we have just seen what this apparent simplicity is worth.

There has not hitherto been any physiological reason for thinking that, after a month, or more or less, of the same alimentation, the living organs will, at the will of the observer, be opened like a register, to regulate the nitrogen passed off by the nitrogen taken in, and to make the elimination of a day, or of a certain period of days, correspond with the food consumed in the same lapse of time; it is, therefore, evidently a gratuitous hypothesis, the demonstration of which will not be easy.

I may add, in conclusion of these remarks, that the evaporation of the rabbit's urine on a sand-bath to the syrupy consistence, or simply until its bulk is reduced to one-half or one-third, allows 25, 30, and even 50 per cent. of the nitrogen which it contains to escape, even when we concentrate only a few grammes of that liquid. Acidulated rabbit's urine, and the normally acid urine of man, likewise undergo considerable losses of nitrogen by evaporation in a sand-bath.

In all the experiments of physiological statics whose detail I know, the urine has been previously evaporated.

I do not wish to criticise: I merely notice difficulties which are not, perhaps, presented in the highly-esteemed works already possessed on the subject. But these difficulties are very real; they force us to reckon more with the irregularity of the acts of life; they call for a minute description of the means used, as well as a severe study and discussion of the degree of confidence which each method permits.

In an early communication I will show that direct organic analysis is not confined to indicating some stumbling-blocks of observation; it surmounts others, and is not always reduced to negative results.

ANALYSIS OF CALIFORNIAN GOLD.*

BY F. OSWALD.

The sample analysed was sent from London, and consisted of small particles, weighing respectively 48, 30, 24, and 18 grains, with some fine ferruginous sand containing some iron and a few particles of sulphuret of lead.

The gold was of a very deep color; a fine streak like the finest ducat gold; it had a dull appearance, occasioned by brownish red peroxide of iron, alumina, silica, and calcareous sediment, which were partially removed by digesting in sulphuric acid, after which the specific gravity of the pieces was 17·4. The composition in 100 parts was as follows:—

Gold	87·6
Silver	8·7
The residue consisted of—	
Peroxide of iron, Alumina, Lime, Silica, Moisture	1·7
	2·0
	100·

and a trifling loss.

Mr. T. H. Henry found:—

Gold	88·75
Silver	8·88
Copper and iron	0.85
Siliceous residue	1·40

Consequently the alloy of gold and silver contained in it consists of:—

Gold	909·66
Silver	90·34

Mr. T. H. Henry found:—

Gold	90·01
Silver	9·01
Copper	0·86

corresponding to an alloy of 21·48 carats. The comparison of Oswald's and Henry's analyses proves that there is not always the same amount of silver in the Californian gold; and that the quantity and nature of the accompanying constituents vary according to the soil, and the greater or less care taken in the washing.

* *Annalen der Chemie und Physik*; Von J. C. Poggendorf.

ON THE DIFFUSION OF LIQUIDS.*

BY PROFESSOR GRAHAM, F.R.S.

The apparatus used in studying the diffusion of salts and other substances was very simple. It consisted of an open phial to contain a solution of the salt to be diffused, which was entirely immersed in a large jar of pure water, so that the solution in the phial had a free communication with the latter. Phials cast in a mould of the capacity of four ounces of water, or nearer 2,000 grains, were generally employed, ground down to

* Abstract of the Bakerian lecture delivered at the Royal Society by Professor Graham, F.R.S., &c., Dec. 21, 1849.

a uniform height of 3·8 inches: the neck was 0·5 inch in depth, and the aperture or mouth of the phial 1·25 inch in diameter. The solution to be diffused was poured into the phial until it reached the point of a pin dipping exactly 0·5 inch into the mouth of the bottle. This was the "solution cell" or bottle, the external jar the "water jar," and the pair together form a "diffusion cell." The diffusion was generally stopped after seven or eight days, by closing the mouth of the phial with a plate of glass, and then raising it out of the water jar. The amount of salt having found its way into the water—called the diffusion product—was then determined by evaporating to dryness.

The peculiarities of liquid diffusion first examined in detail had reference to common salt.

It was proved, first: that of solutions containing 1, 2, 3, and 4 per cent. of salt, the quantities diffused out of the phials into the water in the jars, and re-obtained by evaporation, in a period of eight days, were in this proportion 1, 1·99, 3·01 and 4·00; and, in repetitions of the experiment, the results did not vary more than 1-40th part. About 1-18th of the salt was diffused out in such experiments.

Secondly, that the proportion of salt diffused increases with the temperature; at 80° F. the quantity of chloride of sodium diffused in the same time was doubled.

The diffusibility of various substances was next compared; a solution of 20 parts in 100 parts of water, being always employed. The following were some of the results, the quantities diffused being expressed in grains:—Chloride of sodium, 58·68; sulphate of magnesia, 27·42; sulphate of water, 69·32; crystallised cane-sugar, 26·74; starch-sugar, 26·94; gum arabic, 13·24; albumen, 3·03. The low diffusibility of albumen is very remarkable, and immediately suggests to the mind the value of this property in retaining the serous fluids within the blood-vessels. Common salt, sugar, and urea, added to the albumen under diffusion, diffused away from the latter as readily as from their aqueous solutions. Urea is as highly diffusible as chloride of sodium.

On comparing the diffusion of salts dissolved in ten times their weight of water, it was found that isomorphous compounds generally had an equal diffusibility, chloride of potassium corresponding with chloride of ammonium, nitrate of potassa with nitrate of ammonia, and sulphate of magnesia with sulphate of zinc; it is most remarkable that these pairs are "equi-diffusive," not for chemically-equivalent quantities, but simply for equal weights. The acids differed greatly in diffusibility, nitric acid being nearly four times more diffusive than phosphoric acid; but these, likewise, fell into groups—nitric and hydrochloric acids appearing equally diffusive; so, likewise, acetic and sulphuric acids. Soluble sub-salts, and the ammoniated salts of the metals, present a surprisingly low diffusibility; the quantities of the three salts, sulphate of ammonia, sulphate of copper, and the blue ammonio-sulphate of copper, diffused in similar circumstances, being very nearly as 8·4 and 1.

When two salts are mixed in the solution-cell, they diffuse out into the water atmosphere independently of each other, according to their respective diffusibility. This is analogous to the diffusion of mixed gas into air. An important deduction is, that in liquid diffusion we have a new method of separating or analysing many soluble bodies, quite analogous in principle to the separation of unequally volatile substances in the process of distillation; thus, it was shown that chlorides diffuse out from sulphates and carbonates, and salts of potash from salts of soda; and that from sea water the salts of soda diffuse faster into pure water than the salts of magnesia. This latter circumstance served to explain the discordant results which have been obtained by different chemists in analyses of the water of the Dead Sea, taken near the surface; as the lake is periodically covered with a sheet of fresh water, into which the salts diffuse up with unequal rapidity.

It was further shown that liquid diffusion may produce chemical decompositions; the constituents of a double salt of so much stability as common alum being separated, the sulphate of potassa diffusing in the largest proportion. The diffusive force is, in fact, one of great energy, and is quite as capable of breaking up compounds as the unequal volatility of their constituents. Many empirical operations in the chemical arts, it was said, have their foundation in such decompositions.

Again, one salt will diffuse into a solution of another salt as rapidly as into pure water—for instance, nitrate of potassa into nitrate of ammonia; the salts appearing mutually diffusible, as gases are known to be.

Lastly, the diffusibilities of the salts into water, as those of the gases into air, appear to be connected by simple numerical relations, which are best observed when dilute solutions of the salts are contained in the solution-cell—such as 4, 2, or even 1 per cent. of salt. The quantities diffused, in the same time, from 4 per cent. solutions of the three salts, carbonate of potassa, sulphate of potassa, and sulphate of ammonia, were

respectively 10·25, 10·57, and 10·51 grains; a similar approach to equality was observed in the 1, 2, and 6¼ per cent. solutions of the same salts; this continued in different temperatures. The diffusibility of acetate of potassa appeared to coincide with the same group as did the ferro-cyanide of potassium. Another equi-diffusive group appeared to consist of nitrate of potassa, chlorate of potassa, nitrate of ammonia, chloride of potassium, and chloride of ammonium. The periods in which an equal amount of diffusion took place in these two groups appear to be as 1 for the second to 1·4142 for the first, or as 1 to the square root of 2. Now, in gases, *the squares of the periods* of equal diffusion are *the densities of the gases*. The relation between the sulphate of potassa and nitrate of potassa groups would, consequently, be referable to the diffusion molecule, or diffusion vapor of the first group having a density represented by 2, whilst that of the second is represented by 1.

The corresponding salts of soda appear, likewise, to fall into a nitrate and a sulphate group, having the same relation to each other as the potash salts.

The relation of the salts of potassa to those of soda, in periods of equal diffusibility, were, apparently, as the square root of 2 to the square root of 3, which gives the relation in density of their diffusion molecules, as 2 to 3. Hydrate of potassa and sulphate of magnesia were less fully examined, but the first clearly showed double the diffusibility of sulphate of potassa, and four times that of the sulphate of magnesia. If these are all squared the following remarkable ratios are obtained for the densities of the diffusion molecules of these different salts, each of which is the type of a class of salts; hydrate of potassa 1, nitrate of potassa 2, sulphate of potassa 4, sulphate of magnesia 16, nitrate of soda 3, and sulphate of soda 6.

It was, finally, observed that it is these diffusion molecules which are concerned in solubility, and not the Daltonian atoms or equivalents of chemical combination; and it was pointed out that a knowledge of the diffusibilities of different substances was applicable to a proper study of endosmose.

ON THE PRESENCE OF HIPPURIC ACID IN THE BLOOD.

BY MM. F. VERDEIL AND CH. DOLLFUS.

We have the honor of communicating to the Academy one of the results of the investigations which we have been making on the blood. We have proved the presence of hippuric acid in the blood of the ox; the blood used in our experiments was collected by ourselves in the slaughter-house, the experiments were repeated on the blood of several oxen, and always showed the presence of hippuric acid. We were enabled to separate this substance completely from the blood, and we studied it with care. We could not obtain sufficient of this substance to make an elementary analysis of it, but we ascertained that it was the same substance which is met with in the urine of the herbivora, and which is called hippuric acid. from the form of the crystals seen through the microscope, their insolubility in cold water, and their solubility in hot water, alcohol, and ether; this body melts with heat and decomposes, giving out the characteristic odor of benzoin. The process which we adopted for isolating this substance being a part of the general method by which we are guided in our analysis of the blood, we reserve the description of it until our investigations are completed.

* *Comptes Rendus*, No. 26; Dec. 24, 1849.

RESEARCHES ON THE PRESENCE OF LEAD, COPPER, AND SILVER, IN SEA-WATER, AND ON THE EXISTENCE OF SILVER IN ORGANISED BEINGS.*

BY MM. MALAGUTI, DUROCHER, AND SARZEAUD.

The communication which I have the honor of making to the Academy, in my own name and in those of MM. Durocher and Sarzeaud, has for its object to make known an abstract of the investigations we have made on the presence of silver, lead, and copper, in sea-water. We have been decided in our researches by a fact to which two of us have already had the honor of calling the Academy's attention. M. Durocher and I have long ago shown that silver is very much distributed in metallic minerals. Its absence from galena, for example, is, as is known, only an exception; in blendes and pyrites, its presence is very common. But as sea water is capable, in time, of converting all the substances which it dissolves into chlorides, it occurred to us that it might contain some of those metals which, in the form of sulphurets, it meets with in the lands which it washes or covers. Such were the motives of our researches; but we undertook them only after having obviated every kind of error by a careful examination of the reagents and vessels which we used.

* *Comptes Rendus*, No. 26; Dec. 24, 1849.

We proved by two different methods the presence of silver in the water of the ocean, taken at a few leagues from the coast of St. Malo, and we controlled our results by seeking for this metal in the fucus of the same spot. Of all that we tried the serratus and the ceramoïdes were the richest; their ashes contained at least $\frac{1}{100000}$, whilst sea water contains only a little more than $\frac{1}{1000000000}$.

If sea water is argentiferous, sea salt and all the artificial products which are derived from it must also be so. Indeed, experiment has shown us that this is the case.

Sea salt, ordinary muriatic acid, and factitious soda, contain small quantities of silver. But does the generality of the fact depend on a constant law or on a number of variable causes? We hoped to solve this problem by examining the rock salt of Lorraine, which very probably represents the ancient seas. We have been so fortunate as to find silver in it. The presence of this metal in sea water depends, therefore, on a constant law.

Never losing sight of our starting point, we asked ourselves if terrestrial plants would not assimilate, by means of their roots, the silver, which, in the state of solution, may be presented to them by the subterranean water. This water, mineralised by several salts, and among others by chlorides, would be enriched with silver in consequence of its action on the metallic sulphurets which it would meet with in its course. The examination of the ashes of a mixture of different essences has left us in no doubt as to the presence of silver in vegetable tissues. This last fact pointed out to us another, namely, the existence of this same metal in the animal economy. We think we have proved this in experimenting on considerable quantities of bullocks' blood.

Finally, it remained for us to seek in ancient vegetables a new testimony of the extreme diffusion of silver, and of its independence of every accidental cause or inherent to the modern world. We therefore examined the ash of pit coal, and we must say that the presence of this metal did not seem so well demonstrated as in the ashes of modern vegetables.

After several fruitless attempts, we gave up ascertaining directly the lead and copper in sea water; but, nevertheless, we are convinced of their existence in it, from examining several kinds of fucus. We detected in their ashes $\frac{1}{100000}$ of lead and a little copper, which proves that if the quantity of these two metals in sea water is so small as to escape our re-agents, it is not so small as to escape the assimilating power of plants.

To conclude, the principal facts to which we call the attention of the Academy are:—the presence of silver in the sea, in rock salt, and in organised beings; the presence of lead and copper in certain species of fucus, and, consequently, in the medium in which these plants live.

IMPROVEMENT IN MAKING OXYGEN GAS.

BY M. DAMBERGER.

In manufacturing oxygen gas with peroxide of copper and chlorate of potassa, the greatest inconvenience consists in recovering the unaltered oxide from the very *hard* chloride of potassium remaining in the retort; this is often so troublesome, that the retort must be broken at once to get out the residue. I have a plan that renders this quite unnecessary. All that is required is to mix a rather large amount of some deliquescing salt along with the mixture; for I find that no other soluble salt, not even the sulphate, will cause double decomposition, which is very strange, and probably depends on its sparing solubility; therefore, the range is very great. Any very soluble salt will answer just as well as another; of course, we must except saline compounds, decomposable at a red heat, or the oxygen would be greatly contaminated. The nitrates and organic salts are incompatible; the chloride of calcium is a cheap salt, and being at the same time very suitable, will, perhaps, be used in preference to every other.

NOTE ON EUDIOMETRICAL ABSORPTIONS AND COMBUSTIONS.*

BY M. DOYÈRE.

Relative to the general processes of eudiometry, I have noticed the following results:—

1. Among the absorbents of oxygen, one alone, the ammoniacal solution of protochloride of copper, appears to me to unite all the conditions indispensable for employment in eudiometry. Again, this means of absorption, to be accurate, appears to me to require a sustained agitation with the gas, and which I call *fractioned absorption*, which consists in submitting the gas successively to different portions of the re-agent, taken without any alteration and endowed with all its energy.

2. The prolonged duration of the action of absorbents cannot be employed as a

* *Comptes Rendus*, 2e Semestre, 1849, No. 21.

eudiometrical means, on account of the variations of pressure and temperature.

3. The mixture of oxygen and hydrogen in the proportion in volume of 1 to 2 (oxyhydrogen mixture), disappears completely by explosion in oxygen, hydrogen, and nitrogen gases, provided only that it enters in sufficiently large proportions. It is not the same with the gas of the battery; at least, I have been able to obtain by the electrical decomposition of water only mixtures giving from 3 to 5 per cent. of residue when they were inflamed in the detonator, alone or mixed with nitrogen or hydrogen. Their apparent disappearance in oxygen is only a singularity resulting from the composition of the residue, which is formed of hydrogen and nitrogen in the proportion of 2 to 1.

Without pretending that it is impossible to obtain by the decomposition of water the theoretical oxyhydrogen mixture entirely disappearing in the detonator, I think that the employment of the gas of the battery in eudiometry requires a correction relative to the cause of error here noticed.

4. The order according to which oxygen, nitrogen, and hydrogen gases, resist the explosion of the oxyhydrogen mixture, is indicated by the following progression:—For the explosion of the mixture to be complete, it must enter to about 20 per cent. into oxygen, 30 to 35 per cent. into nitrogen, and 45 to 50 per cent. into hydrogen. These proportions vary with the energy of the sparks, and with the pressure under which the explosion takes place; but the order of resistance remains the same.

5. In atmospheric air, and in mixtures of oxygen and nitrogen, the proportions of the oxyhydrogen mixture, which burn exactly, are confined within very similar superior and inferior limits. Below 20 per cent. of the volume of air, the oxyhydrogen mixture burns incompletely, and leaving so much the greater remainder as its proportion is less.

Above 45 per cent., the high temperature of the combustion determines the combination of the elements of the air, and the formation of nitrous products. The energy of the sparks and the pressure exert on this double phenomenon an influence of the same order as on the inflammation of the explosive mixtures.

ATOMIC WEIGHT OF OZONE.*

BY G. OSANN.

THE black precipitate which ozonised oxygen throws down from a solution of nitrate of silver mixed with ammonia has been recently found by Osann to consist of 97·56 per cent. of silver and 2·44 of oxygen. He has since repeated the experiments. He obtained the black precipitate by passing atmospheric air over pieces of phosphorus in a long glass tube, then conveying the ozonised air into an ammoniacal solution of nitrate of silver. After having washed and dried the precipitate, he reduced it by hydrogen. The following results were obtained:—

	Weight of substance employed. Grammes.	After treatment with hydrogen. Grammes.	Per centage of silver. Grammes.	Per centage of ozone-oxygen. Grammes.
1.	0·5772	0·5624	97·35	2.65
2.	0·4142	0·4030	97·24	2·76
3.	0·5180	0·5035	97·20	2·80

The mean of these numbers, 97·26, nearly coincides with the first experiment. It differs from the composition of protoxide of silver, $Ag^2 O$, agreeing better with the formula $Ag^3 O$. Possibly the black precipitate is not an oxide, but a combination with a peculiar substance, called by M. Osann, provisionally, *ozone-oxygen*. This view is strengthened by the composition of the oxide of lead precipitate recently described by the author, which he obtained by passing ozonised oxygen through a solution of oxide of lead in potassa. The analysis of that precipitate gave 94·85 per cent. of lead, whilst oxide of lead (Pb O) requires 92·86 per cent. Should ozone-oxygen be a distinct body, it must have a separate atomic weight; this consideration led M. Osann to calculate its weight from the composition of these lead and silver compounds. In the lead compound he found:—

$$\frac{5{\cdot}15 \times 103{\cdot}738}{94{\cdot}85} = 5{\cdot}63;$$

using the composition of the silver compound, as the basis of calculation, he obtained, assuming that it contained 2 atoms of silver:—

$$\frac{2{\cdot}74 \times 2{\cdot}108{\cdot}146}{97{\cdot}26} = 6{\cdot}10.$$

These results differ more than was to be expected in determinations of the atomic weight; but they were not made for that purpose. They seem to prove that ozone-oxygen has a definite atomic weight; that it is certainly not a modification of oxygen, but a distinct substance, like chlorine, bromine, &c.; but it is not yet ascertained whether it is of a simple or compound nature. If ozone-oxygen be admitted to be a distinct body, this explains, in a very simple manner, how oxide of lead is precipitated from its solution in potassa, and silver from the solution of nitrate of silver in ammonia.

* *Annalen der Chemie und Physik*; Von J. C. Poggendorf.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

ON THE ALLOYS OF GOLD AND SILVER USED IN THE MANUFACTURE OF JEWELLERY, PLATE, &c, WITH AN EXPOSITION OF THE VARIOUS FRAUDS PRACTISED THEREIN.

BY WILLIAM GRIFFITHS, WORKING GOLDSMITH.

LETTER I.

To the Editors of The Chemist.

DEAR SIRS,—Having been, for many years, engaged in the preparation of the alloys of gold and silver, and in the manufacture of jewellery, plate, &c., in some of the most extensive establishments in the United Kingdom, I am induced to call the attention of the readers of your valuable periodical to the processes employed, and to the numerous facts which have come under my observation during my long practical experience.

The profound secresy observed by the few really practical men who can give information on the subjects I am about to treat of has prevented the scientific inquirer from becoming acquainted with the facts connected with these important arts; and, I regret to say, that those who ought to be foremost to assist the philosopher in his investigations too frequently purposely mislead him. Hence, science is shut out from the advantages which might accrue from a general dissemination of the processes and facts belonging to these manufactures, amongst those whose scientific knowledge might enable them to effect considerable improvements in them, to the undoubted benefit of the manufacturer and the public.

Hitherto these "secrets" have been handed down, by oral communication, from father to son, even apprentices being kept in ignorance of them, being permitted by their masters to acquire a knowledge only of simple mechanical operations. Thus many valuable processes have been totally lost to science, owing to jealousy and selfishness; and, moreover, the public has been kept in entire ignorance of the value, or, too frequently, of the valuelessness, of the articles of jewellery and plate even in most common use. If, by laying before the scientific world all the processes commonly employed by the refiner and the alloyer—the manipulations practised by myself and others—the infamous frauds perpetrated by the very numerous dishonest manufacturers—I may be permitted to hope that I have done some service to science, and paved the way to a repression of, perhaps, the most gigantic, widely-diffused and wonderful system of robbery ever known, I shall deem myself more than repaid for the pains I shall bestow on my task.

I do not intend to recapitulate the facts established by Faraday, Brande, Hatchett, Fresenius and other eminent chemists, with which your readers, doubtless, are sufficiently acquainted, but merely to lay before them the practical processes adopted by the "trade," commencing with

I. THE ALLOYS OF GOLD.

Gold ore, as it comes to us, contains silver, copper, earthy matters, lead, iron and, sometimes, platinum and its accompanying metals. I have found the following process most economical for extracting the gold and silver. I take a portion of the ore (four ounces), put it into a crucible, and subject it to a red heat in a blast furnace; then, while hot, the ore is thrown into cold water, by which treatment it is disintegrated; it is next dried, pulverised, and then washed to remove the lighter particles. I then add to the residuum—

Nitrate of potassa	of each 4 oz.
Common salt (chloride of sodium)	
Potassa.....	
Sandifer	1 oz.

I then place the entire mass in what is technically termed a "skittle* pot," which, as it is narrow at the top, prevents the fused mass from boiling over. It is then exposed in the furnace to a heat sufficient to reduce the salts to a thin flux, in which state it is allowed to remain until intumescence ceases, at which point it will be found that the inferior metals have entered into combination with the salts. The crucible is then carefully removed from the furnace and allowed to cool; when quite cold it is broken, and the metallic button is weighed in order to ascertain the loss by foreign matter. This button, which consists of gold, silver and platinum (if any of the latter be present in the ore) is then placed in a small Hessian crucible and again returned to the furnace; when in a state of fusion it is removed, and poured into a vessel of cold water, kept in a

* A vessel resembling in shape that toy from which it derives its name.

state of agitation in order to granulate it. The grains are then dried, and one of them tested with nitric acid If the amount of silver and platinum (when the latter is present) predominate, the acid acts at once on the surface. If otherwise, I weigh 12 grains of the compound and add silver, fusing each time by the blow-pipe, grain by grain, until cold nitric acid produces chemical action on a part of the surface previously scraped to remove any oxide. I then weigh the button and determine the amount of silver which has been added. I then take the rest of the grains and add silver in the same proportion as I did to the 12-grain test, which will reduce its quality to the "parting alloy," namely, 9-24ths of gold. I then fuse the entire mass in a crucible, as before, and granulate; after this process the grains are digested in nitric acid in a Florence flask on a sand-bath, in order to dissolve the silver and platinum;* thus, the grains, divested of their silver, &c., present the same apparent form as before, although in a spongy state and of a brown color. I leave the gold thus for this reason:—When gold is dissolved in nitro-hydrochloric acid platinum is also taken up—hence the purity of the gold might be doubtful, even if treated with muriate of ammonia. The silver being of less consequence, I prefer treating it with nitric acid which yields the solution of silver and platinum together. I wash the grains of gold with boiling water to remove any nitrate which may remain. I then anneal the gold, mix with it a small quantity of potassa, and fuse in a crucible into a button, which is then perfectly pure.

I then treat the liquor resulting from the washing of the grains of gold with muriate of ammonia, which precipitates the platinum, if any be present, or ferrocyanide of potassium to precipitate the silver; or, if the amount of platinum be small, which can be ascertained by treating with chloride of tin†, I precipitate the silver in the metallic form, by placing a piece of copper in the dilute solution, which silver is afterwards collected, washed, and fused with a small portion of nitrate of potassa into a button, and is then also quite pure.

I now proceed to describe the alloys of gold. That which is called 22-carat gold, or "old standard," is the alloy used for the gold coin of this country: it consists of $\frac{11}{12}$ gold and $\frac{1}{12}$ alloy. The standard coin contains, in some instances, more silver than copper, and *vice versâ*. I have, also, detected in some sovereigns slight traces of zinc and antimony. Those which contain a greater proportion of silver than copper are, necessarily, paler in color, which may, sometimes, be owing to the presence of platinum, remaining (if I may use the term) in a *latent* state during the imperfect process of cupellation. It is a well-known fact that a very small portion of platinum will destroy the red color of gold;* for instance, some gold sold to me as pure, obtained from the county Wicklow, in Ireland, contained:—

Gold.....	96·0
Platinum.....	1·0
Lead	0·5
Copper	1·5
Silver	1·0
	100·0

showing that the small amount of platinum present (which occasioned its paleness of color) had a greater influence than if it had been merely mixed with the inferior metals.

I am also of opinion that the paleness of color of the ancient Irish and Scotch ornaments arises from the same cause; for, in some fragments of ancient ornaments, &c., which I have examined, traces, not only of silver, but of platinum and its alloys (in which osmium-iridium preponderated).†

The formula of the alloy of gold used by goldsmiths, called the 22 carat gold alloy, is,—

	oz.	dwt.	gr.
Gold.....	0	18	8
Silver	0	0	16
Copper.....	0	1	0
	1	0	0

I next proceed with the process of mixing the metals, as given above, to form the 22 carat alloy. It must be obvious to all acquainted with the action of oxygen on inferior metals (particularly when the latter are used in large quantities), that a considerable amount of oxide is formed on the surface of copper, brass, and all such metals as are capable of rapid oxidation. The presence of such oxide in melting is most objectionable, as such particles of oxide, though comparatively minute, do not ac-

* Platinum in combination with silver is soluble in nitric acid.

† Chloride of tin produces a red precipitate of platinum in the above solution, if it be considerably diluted.

* Six parts of gold and 2 parts of platinum, fused together, form a grey compound, resembling platinum in appearance.

† I am indebted to my esteemed friend, Mr. Alexander Watt, for his kind assistance and chemical instruction during the progress of the above experiments.

tually combine with the metals, but continue floating on their surface, when fused, and at length enter into the alloyed compound in insoluble particles, disseminated through the mass, thereby offering a decided opposition to its ductility, and frequently rendering it necessary that the repeated operation of fusion, and even deflagration, should be resorted to, which occasion great loss both of time and material. To obviate this objection, I take the copper or brass I intend to alloy with, and either silver or gild it very slightly, by the electro process (having first removed all oxide, by means of nitric acid), the portion of the superior or less oxidisable metal deposited, though so small as to be of almost no expense—not, perhaps, more than a grain on the ounce—is still sufficient to prevent the objectionable result and render the operation certain. I then place the amount of silver and copper (with a little borax to promote fusion) in a crucible and place in a charcoal forge, supplied with a bellows, and when perfectly melted, add the gold and allow all to remain in the fire till the mixed metals become a perfectly clear and apparently transparent button, of a light green color; it is then cast into an iron mould, called a skillet, and when cold the ingot is rolled to a certain thickness; slips are then cut off and hammered, and drawn through the steel plates to form wire, or the entire ingot is rolled between sheet rollers to the size the workman may require. This is the alloy of gold of which the wedding rings are made in England and Scotland; but they are made of a much lower quality in Ireland, as it is not compulsory there to have them Hall marked. This alloy is seldom used, except for those very necessary articles, and it would be well were the material used for them, as nearly pure as possible, as the purer the gold is in an article in constant wear (though much softer) the longer it will last, which I attribute to its being the less liable to loss from oxidation (the presence of dust or the repeated washing of the hands) in consequence of its density, hence its weight. The process of drawing wire is merely that of reducing the end of the strip (by the hammer) smaller than the other, and drawing it through graduated holes in a steel plate by means of pincers, pliers, or draw tongs, so called from the purposes for which they are used, into whatever shape and size may be requisite for the article to be formed. The process for soldering, or uniting two parts or ends, is thus:—The immediate surfaces to be united are first cleared or filed, then closed or tied together with slight iron wire; the parts are then painted (if I may be allowed the term) with a solution of crystallised borax, rubbed on a slate with water, to the consistence of cream; a small piece of solder, called a palliene, is then laid on immediately over the junction, and heat applied, by means of the blowpipe, until the solder (if any were used) fuses or runs itself into the interstice, is then removed, and the article placed in a solution of one part sulphuric acid with sixteen parts water, or sal enixum pickle may be used to remove oxide and the glassy flux of borax. The junction of the ends of the metals is then as perfect as if it were all one piece.

I give a formula of the solder—

	oz.	dwt.	gr.
Gold, 22 carats..	0	1	0
Silver	0	0	3
Copper	0	0	2
	0	1	5

Or this—

	oz.	dwt.	gr.
Gold, 22 carats..	0	1	0
Silver	0	0	3
Brass	0	0	1

This makes a more fusible solder for filagree work, and as these metals are fused together on charcoal, and rolled thin, and cut into small pieces, called palliens by European goldsmiths, but may be found occasionally in Indian ornaments, where, sometimes, the gold is worked nearly pure. Filagree work is seldom made of 22 carats gold. The article taken from the pickle, as it is technically termed, is then put in shape, filed up to form and smoothness, and then either rubbed with water Ayr stone, to remove file marks, or with emery-paper; it is then annealed, thrown into pickle, if for coloring, and is ready for the coloring process or polishing, as the case may be; if colored (that is, giving the fine gold appearance) it is treated thus—

Troy Weight. Take—	lbs.	oz.
Nitrate of potassa (saltpetre) ..	1	0
Common salt (chloride of sodium)	0	6
Alum	0	6

These salts are dissolved in a small quantity of water in a crucible large enough to allow of boiling; the article is then placed in a saline solution whilst boiling, and the boiling is allowed to continue for a few minutes, then removed and rinsed in boiling water, again placed in the solution, again removed and rinsed, and the operation repeated until the article assumes the required color. This coloring process is not the best for the lower alloys of gold, but in speaking of them I shall give the various processes I have found best for each individual alloy; the article is then dried in heated boxwood dust, and burnished by rubbing any part requiring to be brightened

with a hard steel or stone burnisher, moistened with soap and water, and again washed in soap and water, and dried. It is now ready for sale.

I am, gentlemen, yours truly,

WILLIAM GRIFFITHS.

92, Grafton-street, Dublin,
15th January, 1850.

ANALYTICAL INVESTIGATIONS CONCERNING THE RED COLORS EMPLOYED IN PAINTING ON PORCELAIN.*

BY M. SALVÉTAT,

Chemist to the National Manufactory of Porcelain at Sèvres.

(*Concluded from page* 164.)

VI. RED, No. 5 (Pannetier).—No. 64, LAKE RED (Sèvres).

	In 0·5000 grm.	Per cent.
Silica	0·0820	16·40
Oxide of lead..	0·2472	49·44
Borax.....	0·0798	15·96
Oxide of iron..	0·0910	18·20
Alumina.....	traces	traces
	0·5000	100·

VII. IRON VIOLET, No. 6 (Pannetier).—No. 66, PALE VIOLET RED (Sèvres).

	In 0·9380 grm.	Per cent.
Silica	0·1580	16·85
Oxide of lead..	0·4752	50·66
Borax.....	0·1188	12·66
Oxide of iron..	0·1860	19·83
Alumina.....	traces	traces
	0·9380	100·

In commerce this color and those which follow are designated under the general name of iron violets.

VIII. IRON VIOLET, No. 7 (Pannetier).—No. 66 A. VIOLET RED (Sèvres).

	In 0·8300 grm.	Per cent.
Silica	0·1360	16·39
Oxide of lead..	0·4193	50·52
Borax.....	0·0997	12·01
Oxide of iron..	0·1750	21·08
Alumina.....	traces	traces
	0·8300	100·

All these oxides are obtained by submitting to a more and more intense heat the oxides resulting from the decomposition by heat of the sulphate of protoxide of iron.

IX. IRON VIOLET, No. 8 (Pannetier).—No. 66 B. DEEP VIOLET RED (Sèvres).

Pure oxide of iron calcined in the strongest fire cannot give a deeper tone than violet No. 7, which must, therefore, be regarded as the limit of the intensity at which we can arrive with oxide of iron without the assistance of another oxide. All the attempts which I have made to obtain a deeper violet have been without result. In examining whether the oxide of iron contained in violet No. 8 was free from other oxides, I readily detected the presence of manganese.

The analysis was made by the process already pointed out. The oxide of iron was not separated from the oxide of manganese; it was sufficient to prove the presence of this latter oxide. I found—

	In 0·4950 grm.	Per cent.
Silica	0·0820	16·56
Oxide of lead..	0·2480	50·09
Borax.....	0·0760	15·36
Oxides of iron and manganese	0·0890	17·99
Alumina.....	traces	traces
	0·4950	100·

X. IRON VIOLET, No. 9 (Pannetier).—No. 66 C. VERY DEEP VIOLET RED (Sèvres).

The tone of this color is so deep that it presents to the eye only a slight tint of blue; it also contains oxide of manganese intimately combined with the oxide of iron. There is a greater quantity than in the foregoing violet, and it is this excess of manganese that communicates to the color its distinctive vigor.

The analysis was made by the process already described; the oxides of iron and manganese were separated by means of succinate of ammonia, with all necessary precautions. I found:—

	In 1 gramme.	Per cent.
Silica	0·1640	16·40
Oxide of lead..	0·5060	50·60
Borax.....	0·1214	12·14
Oxide of iron..	0·1871	18·71
Oxide of manganese	0·0215	2·15
Alumina.....	traces	traces
	1·	100·

XI. IRON GREY, No. 10 (Pannetier).—No. 66 D. IRON GREY (Sèvres).

This color is in great request; and as its tint is of a very pure and very intense black, it presents great resources to figure painters, who advantageously employ it for shading flesh, without fear of its blackening by baking to a greater extent than is desired. It does not contain oxide of cobalt, but a very large proportion of oxide of manganese. The analysis was made exactly by the method adopted in No. 66 C: it led to the following results:—

* *Annales de Chimie et de Physique*: Nov., 1849.

	In 0·9100 grm.	Per cent.
Silica	0·1555	17·09
Oxide of lead..	0·4305	47·30
Borax.....	0·1548	17·01
Oxide of iron, Oxide of manganese....	0·1692	18·60
Alumina.....	traces	traces
	0·9100	100·

The oxides used for making the colors marked Nos. 66 B, 66 C, and 66 D, are prepared by the same method as the foregoing reds. The introduction of manganese into the mixture is a very delicate operation. I will make known the state in which it is best to use it, in a special note, in which I shall treat of the influence of molecular modifications on the properties of several metallic oxides.

From the foregoing analyses it is evident that all M. Pannetier's iron colors are composed of very nearly the same elements, combined in the same proportions, especially if we unite, in each color, the alumina and the oxides of iron, zinc, and manganese. It is easy to perceive that the fusible principle remains identical; the coloring matter alone varies in color, and we have shown that this variation depends either on the intensity of the heat to which the oxide has been subjected, on the nature of the elements which enter into its composition, or on the proportions in which these same elements are combined.

The mean of all the analyses above detailed leads to the following numbers:—

	Proportions.	Proportions.	
Silica	1 16·72		
Oxide of lead..	3 49·93	80·47	4 flux
Borax	¼ 13·82		
Oxides Fe^2O^3, Mn^2O^3, Al^2O^3, ZnO	19·53	19·53	1 oxide.
	100·	100·	5

Calculation would give—

	Proportions.	Proportions.	
Silica	1 16·85		
Oxide of lead ..	3 50·55	80	4 flux.
Borax	¼ 12·60		
Oxides Fe^2O^3, Mn^2O^3, Al^2O^3, ZnO	20·00	20	1 oxide.
	100·	100	5

These numbers agree as much as possible. The borax alone is in slight excess in the data furnished by experiment; but it must be observed that these data are affected by the loss in the experiment. In two estimations of the borax, by a direct process, 12·51 and 12·12 were found, which approach more nearly to the theoretical number, and which may be regarded as an approximation to truth.

Now that we are acquainted with the composition of the reds which we desired to examine, we shall be able to compare them with those of other chemists. We have commenced by making known the manner in which these latter were prepared; we shall easily be able to establish the proportions of their constituent principles. We find them to be composed of—

	Proportions.	Proportions.	
Silica	1 16·67		
Oxide of lead ..	3 50·00	75	3
Borax	¼ 8·33		
Oxide of iron ..	25·00	25	1
	100·	100	4

In comparing these cyphers with those which precede them, we are forced to admit that the quantities of lead and sand remaining the same, a quantity of the oxide in the first is replaced by its weight of borax. The influence of this substitution on the fusing faculty of the color is immediately accounted for.

The difference which exists between the two series of colors may be presented in a still more evident manner.

In M. Pannetier's colors, the flux is composed of—sand, 1; borax, ¾; [orange minium ?] 3; a compound more fusible than that containing only borax ¼. In these same colors, we find 1 part of coloring oxide to 4 of flux, whilst, in the other colors, we find, to 1 part of coloring oxide, only 3 of flux; a double modification, which increases the fusibility of the color.

I will not dwell long on this cause of the superiority of the colors which form the subject of this note. With respect to glaze, this superiority is evident from the foregoing.

I now enter upon the question of lustre and liveliness of tint; I think that will be very simply solved by what follows:—

I have already said that the difference of tint which the oxide of iron acquired (and here we speak only of pure oxide of iron) depended on the temperature to which it had been carried. I will now add that all these shades are not maintained at the same height; the higher the temperature the more vigorous the tone. I may remark, also, that all the colors which the oxide assumes vary from orange to violet—that is to say, they may be decomposed into yellow, red, and blue, simple colors, which give more or less deep greys, according to the degree of intensity of the three elementary colors. The lower the temperature the more yellow remains; the higher it is, the more blue is added.

It, therefore, appears evident to me that

the color will be so much the purer as the oxide which produces it is formed of molecules, identical by the modification which they have undergone from the same degree of temperature. The tint will, therefore, be perfectly pure if all the molecules have received the temperature necessary for developing it, if none have received a degree of heat capable of modifying it; either too feeble, which would leave too much yellow, or two violent, which would increase the proportion of blue.

The art, therefore, consists in compounding the color only of particles of oxide having undergone the same temperature. This object may easily be obtained by operating only on small quantities at a time, and by constantly stirring the mass. The heating is stopped when the temperature has been maintained for a sufficient length of time; all the successive preparations are then tried, and those only are mixed which appear identical and affect the sight in the same manner, and and it is here that a quick and practised eye is of the first necessity; it is here that artistical studies become the indispensable complement of the chemist's science. Thus, M. Pannetier, who was long and successfully engaged in painting, was enabled to bring this manufacture to a degree of perfection previously unknown.

I have attentively studied the part performed by alumina, which some chemists regard as advantageous and even indispensable, for the easy preparation of very transparent reds. In the course of these investigations, I easily convinced myself that it performs no part. M. Pannetier's reds, with the exception, however, of the orange, in a sample of which I found a considerable quantity in substitution for oxide of zinc, contain only traces of alumina, and oxides which I have prepared in such a manner as to contain a certain proportion of alumina, presented no appreciable superiority over reds made with oxides which contained none.

That no doubt might exist on this point, I took four samples of oxides called martial, made by M. Colcomb Bourgeois, who prepares them very well.

These samples contained:—

	No. 1. Orange.	No. 2. Red.	No. 3. Lakered.	No. 4. Violet.
Sand	6·80	7·04	2·80	9·00
Oxide of iron	88·00	85·66	82·70	76·00
Alumina ..	5·00	7·04	14·00	14·40
Lime	—	—	—	0·50
Loss	0·20	0·26	0·50	0·10
	100·	100·	100·	100·

I mixed them with four parts of M. Pannetier's flux, and I heated the colors thus prepared on Sèvres porcelain. The result was not different from what it was with non-aluminous oxides; still the proportion of alumina was very considerable, especially in Nos. 3 and 4.

I do not pretend to exclude all the qualities of alumina; perhaps for martial preparations intended for miniature painting, or oil painting, it may possess the advantage of diminishing or heightening the color; but I think I may affirm that it is useless in the preparation of vitrifiable colors.

In conclusion, I think I have demonstrated:—That M. Pannetier's reds are more fusible than those of other chemists, for the two-fold reason that they are composed of a more fusible flux, and that they contain less of the coloring principle. I have given the composition of this flux, and the proportions in which it is best to mix it with the oxide; for my own part, from the repeated proof which has been made of these colors, and their well-merited reputation, I do not hesitate to adopt these data:—

That pure oxide of iron, according to the degree of heat to which it has been subjected, may vary from fourth orange red to violet red, without being able to descend to orange, or to exceed in vigor a certain limit: it is necessary, in both cases, to have recourse to additions, in determined conditions, of oxide of zinc or alumina for obtaining orange, and oxide of manganese in increasing proportions, to procure deeper violets.

That alumina seems to be, contrary to the received opinion, without influence, at least, in the conditions in which I operated, on the purity and vivacity of the tint which the pure oxide of iron takes in the circumstances detailed.

I hope that I have explained in a sufficiently satisfactory manner the differences presented, with respect to beauty of tint, by oxides of iron of an equal degree of purity. I shall deem myself happy if I have succeeded in pointing out the means of preparing them in the best conditions.

I have endeavored to designate those colors which are not deadened by more fixed and more rational names, by comparing them with the normals of M. Chevreul; I think that the designations of orange, of fourth, third, and second orange red should be adopted in preference to the terms of orange red, capuchin red, blood red, and flesh red, which are vague and independent of each other. The time, probably, is not far distant when the nomenclature, in some measure mathematical, proposed by M. Chevreul, will prevail, not only in science but in industry, over all arbitrary denominations used in laboratories and in workshops.

ON THE COMPOSITION AND APPLICATIONS OF THE JERUSALEM ARTICHOKE.

BY MM. PAYEN, POINSOT, AND FERY.

(*Read before the National and Centra Agricultural Society of France*, 1849.)

PREVIOUS analyses of the Jerusalem artichoke appearing to us to leave some doubts on the mind, we thought it right to endeavor to verify and complete them, especially with the view of appreciating the value of these tubercles as a nutritive substance for men and animals.

We proposed, besides, to examine the influence exerted on their composition by the ammoniaco-magnesian phosphate manure, which has been shown to be very favorable to their development.

The artichokes on which we operated were grown on ground situated at Grenelle, cultivated by the Commission of Agricultural Experiments of the Conservatory; the soil was sandy and of medium fertility.

The determination of the water and of the dry substance of these tubercles gave the following results:—

Fixed substances, organic and mineral	23·96
Water	76·04
	100·00

The dried substance, carefully burned, gave in 100 parts 4.24 of ash. 100 parts by weight of this substance submitted to elementary analysis* gave 2·16 of nitrogen; it is more than double that obtained from dried potatoes, rather more than the fruits of cereals, including wheat.

We extracted from 100 parts of dried artichokes 0.87 of fatty substances, one fluid, the other solid at the ordinary temperature; this proportion is more than double that contained in the dried tubercles of potatoes.

By putting artichokes, previously divided and washed for eight days without heat, in contact with hydrochloric acid diluted with twenty times its bulk of water, submitting the mixture to a pressure repeated five times with addition of a little water, a liquid is obtained from which alcohol precipitates pectine which, dried, represents 1·56 per cent.

The insoluble residue, agitated and left for eight days in contact with a weak solution (at 1-20) of ammonia, gives, by powerful pressure and washing with small quantities of water, a liquid which saturated with a slight excess of acetic acid, then filtered, left on the filter gelatiniform pectic acid, whose weight, after washing and desiccation, represents 3·76 per cent.

The dried substance, completely exhausted by ether, was washed with alcohol at 85 and 60. We thus obtained crude saccharine matter retaining a little chloride of potassium and a small quantity of a nitrogenous matter. This crude saccharine matter forms 68-hundredths of the weight of the dried matter, which would represent 16 of glucose in 100 of artichoke in the normal state.

In observing this considerable proportion of saccharine matter, we were led to verify the accuracy of this cypher by other means of estimation. We operated on 1 kilogramme of artichoke, and we converted the saccharine matter, by fermentation, into alcohol. For this purpose, the artichokes were reduced to a pulp by rasping; the pulp, pressed, gave a juice so dense as to mark 11 Beaumé; we exhausted the pulp by washing and pressure repeated a sufficient number of times. The liquid, mixed with yeast, was submitted to fermentation in a place where the temperature was maintained at 68° F.; the fermentation being completed, we estimated the alcohol by distilling a portion of the liquid in a small Gay Lussac's alembic, and we thus obtained from 1 kilogr. of artichoke 67·92 of absolute alcohol, which represent 147 grms. of glucose, or 14·7 per cent.

We remarked, during the fermentation of the juice of the artichokes, a phenomenon which might, in certain cases, make this application acquire importance; during this fermentation a very considerable quantity of yeast is developed.

The proportion was 50 grammes of yeast for 1 kilogr. of artichokes beyond the weight used for determining fermentation. This property of the juice in question might render the fermentation of artichokes more economical than that of saccharine substances from which alcohol is extracted, and in which, yeast not being reproduced, it is necessary in each operation to employ fresh portions of yeast.

After having determined the proportion of saccharine matter in artichokes, we proved the presence of a gummy matter, albumen and two other nitrogenous substances; finally, we determined, by the usual processes, the proportions of aniline and cellulose.

The artichokes which we analysed had vegetated under the influence of the special manner above-mentioned; it was important to determine accurately the nature and proportion of the mineral substances contained

* The following are the numbers of the analysis:—Substance employed, 1·88; volume of nitrogen 35 cub-centim. Temp. 59° F.; pressure, 75·47; 0·0406 grammes weight of nitrogen in 1·88 or 2·16 per cent.

in these tubercles. We analysed the ashes of these artichokes by the ordinary methods with great care. Our results lead to the following comparison:—

Insoluble matters	43·15	Silica	2·00	6·95	33·80
		Carbonate of lime	4.12	10·23	
		Carbonate of magnesia	1·94		
		Phosphate of lime and magnesia	33·59	16·62	
		Alumina	1·44		
Soluble salts	56·85	Chloride of potassium	8·36	10·75	66·20
		Sulphate of potassa	11·16	10·66	
		Phosphate of potassa	28·40	8·45	
		Carbonate of potassa and traces of soda	8·93	36·34	
			100·00	100·00	

In examining the results of the two analyses, it is remarked that the composition of the ashes, in both cases, differed only by a small quantity of phosphates; in the second analyses, however, the phosphates still form one-fourth of the total weight of the ashes, which shows that artichokes have the property of energetically exhausting phosphates from the soil, and that they are able, in determined circumstances, to absorb and retain a very great quantity of these salts.

By recapitulating the various analytical results, we find the following composition for the tubercles of artichokes in the normal state, grown at Grenelle:—

Water	76·04
Glucose, and other matters	14·70
Albumen, and two other nitrogenous matters	3·12
Cellulose	1·50
Inuline	1·86
Pectic acid	0·92
Pectine	0·37
Fatty matters, and traces of essential oil	0·20
Salts—Phosphate of lime and magnesia, phosphate of potassa, sulphate of potassa, chloride of potassium, citrate of potassa, malate of potassa and lime, traces of soda	1·29
	100·00

Artichokes contain, besides, a small quantity of violet coloring matter, situated in the tissue under the epidermis. This substance is turned red, and dissolved by the mineral acids; acetic acid has very little action on it; ammonia turns it brown, which gradually becomes deeper in contact with the air.

It is seen that the tubercles of artichokes analysed contained, in 100 parts by weight, 23·96 of alimentary substance, richer in nitrogenous, fatty, and saccharine matters, and in phosphates, than in potatoes.

These tubercles do not contain amylaceous fecula and substances, congeneric with the latter (glucose, inuline, gum, &c.); being very easily soluble and digestible, it will be understood that it is necessary to mix the artichokes with other aliments more resistant, and less humid; such, for example, as dry fodder, bran, and grains, which would be ameliorated by this mixture.

The very easy fermentation of the juice of artichokes might render it applicable to the manufacture of alcohol in certain localities; the increase of yeast which this fermentation would cause, to the extent of producing 50 grammes of fresh yeast per litre, would be a circumstance favorable to this operation.

But the most generally useful application which could be made of artichokes would be, doubtless, introducing them into the rations of pigs, of milk cows, and of fattening animals. Their remarkable faculty of procuring from the atmosphere a great part of their nitrogenous organic nourishment, and of deriving from the soil alkaline salts and the phosphates useful to the herbivora, who restore them to the earth by their evacuations, should lead us to hope for favorable results from their application to this purpose.

As to the difficulty of limiting their spontaneous reproduction, that may be prevented by cultivation within boundaries, and especially of plants which are cut down in the green, then making weeded or hoed plants succeed to the latter.

It is known that the stems of young artichokes constitute a good green fodder; and that at the time of their development, they are sufficiently ligneous to give a fuel fit for heating ovens, and ashes which aid in restoring the surface of the soil.

OBSERVATIONS RELATIVE TO THE INFLUENCE OF THE NATURE OF THE SOIL ON VEGETATION.*

BY M. J. DUROCHER.

Two kinds of causes, the one chemical and the other physical, simultaneously exert an

* *Comptes Rendus*, No. 25; Dec. 17, 1849.

influence on the distribution of vegetables on the surface of different lands: whatever explanation may be given of the complex part which lime and its carbonate play in the nutrition of plants, their presence is an indisputable cause of fertility.* The superexcitation of vegetative activity which the carbonate of lime produces permits many special plants to attain to complete developement, and to perpetuate themselves by fructification. We must remember, in the first place, that the various vegetables containing unequal proportions of lime, alkali, and silica, it is in the calcareous formations that they find in greatest abundance the first of these principles, the other two being furnished to them principally by the decomposition of silicates originally arising from pyrogenous rocks; this is, therefore, an evident motive for the preference of plants for a particular soil. However, amongst those which inhabit calcareous soils, some do not require to assimilate a large proportion of lime, but this base acts as an exciting manure, whose influence is not equally favourable to the development of all species, many of which require for their nutrition only a small quantity; thus, on sandy soils, where chemical analysis detects only traces of lime, I have observed plants which, in the west, grow habitually only on calcareous soils, or on the hillocks of the coast.

It is indispensable to take account of the physical influences, which play a part not less important than the chemical causes; they consist principally in the faculty, which the soil possesses in a greater or less degree, of being heated by solar radiation, in its consistence and in its permeability. Calcareous soils, like sandy and gravelly soils, are dry and warm, whilst argilaceous soils are humid and at the same time cold, on account of the evaporation of their water of imbibition, which is a powerful source of cold; also, in spring, they heat slowly and vegetation on them is tardy. Many vegetable species, those which do not require a fertile soil, grow on calcareous lands, on dry, sandy, or stony soils, even when containing very little carbonate of lime. However, there are differences in the characters of the vegetation owing to the texture of the soil, according as it is granular, sandy, or very tenaceous, compact, and more or less fissured. Certain plants which are absent from calcareous formation, require to have their roots fixed in an argilaceous medium, capable of always preserving a certain degree of humidity.

In Britain, the plants of calcareous soils are, so to speak, foreign to the primitive flora of the country; they are naturalised in dry and warm soils, where they have met with the conditions of heat or fertility necessary to them. It is easily understood why many of these special plants are seen, as I have explained in a former memoir, on the hillocks of the coast, where they find dry, sandy soils, ordinarily containing a little carbonate of lime arising from marine detritus.

It is easy to explain the apparent anomalies which the distribution of plants presents, and which have caused the influence of the nature of the soil on vegetation to be regarded as doubtful or irregular; when a calcareous basin is surrounded with exclusively argilaceous soils, the contrast of the vegetables is the more striking; the line of demarcation is distinct; but, if the adjacent earths are dry, stony, or gravelly, if they present physical properties analogous to those of the calcareous soils, many vegetables proper to the latter may be propagated in them to very great distances; then the calcareous basins are like gardens from which spread the plants which are naturalised in them.

The law of the distribution of plants on different soils is necessarily dependent on climate; thus vegetables which, in a rainy, humid, and cold climate, like that of the west of France, thrive only on the driest and warmest soils, may spring upon other soils, in localities where the climate is more serene, and where a more ardent sun facilitates their development. The general character of the British flora is that of a vegetation proper to argilaceous and cold soils, excepting near the coast, and the calcareous basins which present plants of dry and warm soils. I may add that I have observed certain vegetables of the maritime zone, the *Silene maritima*, for example, on hard and dry schists forming crests in the interior of the country.

To explain the sinuosities, which the northern limit of the culture of the vine presents, regard must be had not only to the climate, but also to the composition and inclination of the soil, or else to the greater or less faculty which the soil possesses of drying and

* From calculations I have made, more than 300,000 cubic metres of lime are annually made in Mayenne and Sarthe, five-sixths of which are devoted to argilaceous and silicious lands. This manufacture amounts to 130,000 cubic metres in that part of the Lower Loire comprised between Chalonnes and Ancenis. The fertilising influence of lime is also felt five or six years after having ceased to add it; it is more immediate and more energetic, but it lasts only half as long as friable calcareous stones. Nevertheless, by aid of calcareous amendments, the production of the soil in barley has been doubled and often even tripled.

heating. As I have remarked in many valleys, this culture is seen to be more advanced towards the north, where gravelly and stony soils, also forming hillocks, are found. This influence, which is evident for the length of the limit of which I speak, but which gradually becomes effaced towards the south, equals or surpasses even that of the exposition; for there are vineyard plots on the hillocks whose expositions are very varied, even in the north, as on the left bank of the Loire, in the environs of Nantes; but it is very rare to see them on perfectly horizontal soils, or on argilaceous soils. The limit of this culture advances towards the north-west, near Vannes, on the sandy hillocks of the east of the Morbihan, notwithstanding the unfavorable influence of a maritime climate; it leaves aside the argilaceous lands of Britanny and of the Maine, but it extends to the environs of Paris, where there are gravelly and pebbly hills. Formerly, there were vineyard plots on the declivity of the calcareous mounds of Normandy, and also on the pebbly flanks of some hills of freestone in the interior of Britanny.

I may conclude this note with some observations relative to the landes of the west of the Gironde; their uncultivated state arises from the composition of the vegetable layer, which contains no lime, is generally too argilaceous, and often rests on an impermeable subsoil. Moreover, on account of the peninsular position of Brittany, the elevated lands are exposed to violent and almost perpetual winds. Formerly they were in great part covered with forests, which have been cleared by large surfaces at a time; the results of this improvidence have been disastrous, for the trees, deprived of shelter, have ceased to grow, the country is unwooded, and lands, which formerly were cultivated, are changed into fallow. The replanting and cultivation of the elevated landes can take place only in a gradual and progressive manner, under shelter of dead wood and screens, to be set up close to each other. Besides the construction of trenches for *grubbing* up too humid lands, the success of the tillage requires the employment of mineral amendments, especially of calcareous substances, sea-sands, lime, marls, or friable calcareous stones.* In the absence of these, amphibolic rocks, in the way of decomposition, may be used, the employment of which I recommended several years ago, and which have been found advantageous. Their effect resembles that of marl, owing to the lime which, like the alkalis of feldspar, is set at liberty, and rendered assimilable by the decomposition of the amphibole.

* I have discovered in the east of Brittany several beds of friable, tertiary, calcareous stone, which is now being turned to account for the amendment of soils.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

SANITARY NOTES.

NO. V.

THE subject of Ventilation is one which is far too little understood or appreciated, either by professional and scientific men, or by the inhabitants of houses and frequenters of public buildings; and yet it is scarcely second in importance to any subject connected with sanitary economy. Want of ventilation is a most certain and prolific source of disease. Scrofula, consumption, and fever, in many thousand cases, and in multiplied forms, have been originated by the foul air of close and crowded rooms; and, besides contributing a fearful proportion to present misery, have stamped their hideous seals on subsequent generations, in the form of diseased and debilitated races. That want of ventilation has been the origin of those and other maladies, is proved by the now numerous instances in which their insidious course has been arrested by a simple provision of ventilation.

At a school at Norwood, scrofula broke out amongst 600 pupils, and several deaths occurred. This was attributed at first to the diet; but on investigation that was found to be of superior quality. On further examination, it was found that there was a total want of ventilation in the school apartments; this was remedied, and in a

short time the disease entirely disappeared; since then 1,100 children have been maintained there in good health. At a charity school in London, for 60 boys and 60 girls, scrofula had constantly existed: some time since it was found advisable to build a new set of rooms for the boys, when proper attention was paid to their ventilation. In a short time the disease disappeared from amongst the boys, while it still remained amongst the girls, although the space allotted to them was doubled by the addition of the former boys' apartments. Precisely the same state of things, and the same effects, after improvements, have been observed in the dens of the animals in the Zoological Gardens in London.

The following instance is given by M. Baudeloque:—"At three leagues from Amiens, lies the village of Oresmeaux: it is situated in a vast plain, open on every side, and elevated more than 100 feet above the neighbouring valleys. About 60 years ago most of the houses were built of clay and had no windows; they were lighted by one or two panes of glass fixed in the wall; none of the floors, sometimes many feet below the level of the street, were paved; and the ceilings were low. The greater part of the inhabitants were engaged in weaving. A few holes in the wall, and which were closed at will by means of a plank, scarcely permitted the air and light to penetrate into the workshop. Humidity was thought necessary to keep the threads fresh. Nearly all the inhabitants were seized with scrofula, and many families, continually ravaged by that malady, became extinct; their last members, as they write me, dying rotten with scrofula. A fire destroyed nearly a third of the village; the houses were rebuilt in a more salubrious manner; and, by degrees, scrofula became less common, and disappeared from that part. Twenty years later, another third of the village was also consumed; the same amelioration in building, with a like effect as to scrofula, followed. The disease is now confined to the inhabitants of the older houses, which retain the same causes of insalubrity."

In Spitalfields, Glasgow, Paisley, Manchester, and other places, the average of fever cases is always exceeded when the weavers and spinners are in full work, and therefore in easy circumstances; and diminished when they are out of work, and in consequent distress. The reason is, obviously, that in the former case they are confined all day in close rooms, which have no proper means of escape for the vitiated air, and of ingress for pure air; and in the latter case, they spend much of their time in the open air, seeking for work, or lounging about the streets.

In the various Sanitary Reports, and, indeed, in the experience of every one who has paid any attention to the condition of their fellow-creatures in crowded towns, proofs are multiplied, to a fearful extent, of the prevalence of fevers, &c., amongst the inhabitants of cellars and dirty undrained houses.

Instances are also numerous of the prevalence of fever in the cellars and lower apartments of a dwelling-house, while in the upper rooms it never appears. Contiguity to foul drains, and the places of deposit for house refuse, and a greater difficulty in changing the air, even if there is the desire to do so on the part of the occupant, are sufficient reasons for this. In very many places it will be found that the better disposed of the poor always prefer rooms above the ground floor.

In the "Medical Statistics of New York," by Dr. Griscom, and of Philadelphia, by Dr. Emerson, the same causes and same effects are most strongly illustrated. Indeed, in the latter place, so great is the mortality in the undrained, unventilated courts, alleys, and cellars, that the average age at death, above 20, in the town is below 46, while in Bethnal Green it is nearly 49, and in London generally it is 53; and in the former place the total average age at death is 20½ years while in London it is 30 years.

In workshops where much attention is paid to warming and lighting the rooms in which a number of men are at work, the want of ventilation acts in a different manner to that just stated; for, access to the outer air being quite excluded, the hot vitiated air rises to the uppermost rooms, and consump-

tion and other diseases are more rife amongst those who work there than amongst those in the lower rooms. This subject has been enlarged on by Dr. Guy in his evidence before the Commissioners for Enquiring into the State of Large Towns in 1844. He there also mentions the following case: one set of 40 men were employed in five rooms, having a capacity equal to a rate of 303 cubic feet of air per man; and another set of 40 men were employed in five rooms having a capacity at the rate of 789 cubic feet of air per man; the former rooms were lighted by 60 gas lights, and the latter by 75 gas lights; both sets of rooms were warmed by stoves. Amongst the former set of men, 20 were diseased in some way (five with spitting of blood); in the latter set of men only seven were diseased (none with spitting of blood).

The causes of bad air in buildings where people dwell or congregate, may be divided into two classes, external and internal, *i.e.*, causes acting from outside the building to disseminate bad air into it, and causes acting inside the building to corrupt or vitiate the air that it contains.

Amongst the "external" causes the most prominent is the "cesspools." It will readily occur to many people, that the most complete and the cleanest remedy for these intolerable nuisances is the entire removal of them and substitution of proper house drainage. But this will involve, in many cases, the execution of very extensive works before even one small cottage can be purified, in the shape of public sewers and water-works. It is on this rock that the "General Board of Health" will suffer shipwreck, as the medium of arriving at the sanitary results contemplated by the promoters of the Public Health Act. In the 53 places reported on by Inspectors of the Board, varying in description from a small agricultural parish, with 600 inhabitants, to such towns as Derby and Leicester, the means of effecting the complete purification of the air by drainage and water supply, are stated to be, only by submitting to charges for terms of 30 years, which amount to an increase of from one to two thirds on the present very high poor and other rates. Indeed, so much alarmed do the Inspectors appear to be at the expense of the works recommended, that in many of the reports the cost of adapting the houses to take advantage of the public sewers and water supply, is stated to be a private charge, and is, therefore, omitted in the general summary, as if it were not just as necessary for the purification of a town, to enable the houses to part with their refuse, as to provide the means of carrying that refuse away after it has left the houses. The General Board of Health will find it difficult to induce a town, such, *e.g.*, as Derby, where the annual rates at present exceed £7,800, to submit to an addition of £5,100 for 30 years, and that is the fair way of stating the result of the Inspector's recommendations. In these reports, also, the probability of a revenue from the disposal of the sewage is generally more hinted at than positively expounded; while the means suggested for obtaining this revenue are the execution of such works as were propounded by Mr. Smith, of Deanston, to the Commissioners of 1844, and lately illustrated so magnificently by Mr. Donaldson in his proposition for watering Essex and Cambridgeshire with London sewage.

It fortunately happens, however, that there exist means of removing the nuisance of cesspools, and of completely purifying a house from the pollution of deadly gases from that source, by the use of a material to which much public attention in high quarters is being attracted, viz., peat charcoal. The singular power of this substance to absorb instantly the ammoniacal and other gases, as well as liquids, makes it a most valuable deodoriser and disinfector. It will take up and retain at least 90 to 100 volumes of those gases, and from 80 to 90 per cent. of water, thus retaining the volatile as well as the material parts of sewage; for this reason, as well as on account of its greater portability, this combined material is very superior to liquid sewage as a manure. Upon the value of this manure, however, it is not the purpose of this paper to expatiate.

The two following cases will illustrate the value of peat charcoal as a purifier. In the workhouse of the Swinford Union, co. Mayo, an "intolerable and sickening effluvium arising from the sewers, cesspools, and

privies pervaded every part of the establishment." On the failure of all other remedies, peat charcoal was, by the recommendation of the Poor Law Commissioners, tried, and being mixed up with the contents of those places, "in a few hours the most delicate and practised nose could not have detected the slightest offensive" odor in the building. By occasionally throwing a little charcoal into the cesspools and sewers, "the house is now, as far as entire freedom from every noxious and offensive effluvium, a model to every other in the kingdom." The mortality has, also, on a comparison of two half-years, decreased much more than one-half. (See Report to the Poor Law Commissioners in Ireland.) In a house at Windsor a most offensive effluvium and its companion, fever, prevailed, caused by the gases of the cesspool belonging to the next house rising up through the chinks of the wall. Some peat charcoal was placed against those parts of the wall on which the passage of sulphuretted hydrogen was marked by black stains, and in a short time the house was perfectly free from any bad odor.

In a house provided with ample drains, peat charcoal may be placed in the connecting drain to the sewer; and thus, while permitting water to pass through, will both intercept the valuable refuse in its descent, and the noxious gases from the sewers in their ascent. For slaughter-houses, and other offensive places, this material is equally effective and valuable. In short, peat charcoal affords the means of *immediately* counteracting the noxious sources of many deadly gases, and converting them into a profitable shape, to be used in contributing to the life and support of man. It will not supersede the necessity for sewerage, but it will be the means of making the sewers water-channels (instead of death-stills), for the drainage of the land, and the discharge of the water used for culinary and other domestic purposes. It will, moreover, by prudent management, be the means, when in combination with sewage matter, by which funds may be raised for the construction of sewers, and the extension of drainage. Of all the abounding riches of our sister isle, there are none more valuable, none more neglected hitherto, and none for which there is more ample or higher use than the three million acres of bog-land which are spread over her surface.

Another "external" cause of bad air in dwellings is to be found in the state of the roads or pathways in front of the houses. In one of the suburbs of London, the rapid extension of which during the last ten years has been almost unexampled, streets of good second and third class houses were constructed, and respectably occupied; but from the slow proceedings of the Local Paving Board, those streets were unpaved for several years. The soil being a stiff clay, the water, after a heavy rain, had no means of escape, though efficient sewers existed, and, consequently, became offensively stagnant; the refuse from small shops was also thrown into the muddy ways, and lay there till decomposed; the consequence of this was, that fever was constantly prevalent in a new, open, airy neighbourhood. In Manchester, it has been found that after the paving and sewering of streets, the annual mortality has been reduced as much as 20 in 110. In Chorlton, the mortality in third-class houses in the worst-conditioned streets was as high as 4 per cent.; while, in the same class houses, in better streets, it was only about 2·8 per cent. In Nottingham one of the characteristics of a part of the town where the mortality is 3·1 per cent., and the average age at death so low as 18·1 years, is "unpaved, undrained streets and courts." In addition to the positive generation of disease from the stagnant water and decomposing refuse, always found on unmade roadways, the evil extends further, in the impossibility of preserving cleanliness in houses, where every one that enters must bring in a certain amount of dirt.

One of the most exciting causes of a high rate of mortality in towns, owing to a want of external ventilation, is to be found in the construction of the courts, in which a large amount of the population live. These courts are generally closed at one end (sometimes, indeed, at both ends, with only a narrow passage for entrance); they are narrow, undrained, almost unpaved, and with no pro-

per receptacle for refuse and filth, which, consequently, accumulates on the open area, and are, moreover, densely populated. In addition to the above evils, many places in London have not even any sort of privy; and the whole filth of the court is thrown out before the houses, where it frequently lies for days before a scavenger penetrates such deep recesses to remove it; the contents of drains, moreover, from more favored houses, find their way across the surface of courts, and effectually prevent any possibility of cleanliness.

The following extracts from the "Statistics of Liverpool," by Dr. Duncan, will illustrate this subject in, perhaps, its worse phrase:—"In the parish of Liverpool, the population amounts to 223,054, of which 55,534 reside in 1,982 courts—*i.e.*, one-fourth of the whole population, or one-third of the laboring portion, reside in courts. Of these 1,982 courts, 629 were closed at both ends, 875 open at one end, and only 478 open at both ends. To show how these courts and the streets are crowded together, it may be stated that, in Liverpool, there are 100,000 inhabitants per square mile, while, at Manchester, there are 83,000, and in London only 27,000. But, in the worst district of Liverpool, the density is at the rate of 460,000 per square mile; and, in the worst part of that district, containing 811 houses and 7,900 inhabitants, there were only 6¼ square yards to each inhabitant, being a density of 657,000 per square mile, or nearly 2¾ times the maximum density in the worst part of London. One street in this last portion contained 1,434 inhabitants in 109 houses, 51 of which were situated in courts (being 13·15 to each house), upon a space equivalent to only 4 square yards to each person. In this street the average number of cases of fever in five years was 1 in 10 annually. In another street, with its courts, the number of fever cases were 1 in 7. In this district generally, there are 13·45 square yards to each inhabitant, and, in another district, 22·35; in the former, more than two-thirds of the courts are closed at both ends; in the latter, less than one-fourth are so constructed. The ratio of the *general* population of the two districts attacked by fever was as 1 in 26·21 to 1 in 27·44, but the ratio of fever cases amongst the *court* population so attacked was 1 in 18·96 to 1 in 25·21. The evil of unventilated courts cannot be more significantly stated.

When the above-mentioned circumstances, relating to the residence of a very large proportion of the population, are attentively considered, there can be but small surprise that the average age at death for the whole parish is so low as 17 years, while, in the worst districts of London, it is 25 years. And, at the same time, it must be painfully impressed on those who have influence and power, that great numbers are annually sent to a premature grave from causes, the removal of which is within human control.

J. N. W.

NATURAL HISTORY OF QUINQUINAS.*

BY DR. WEDDELL.

(*Concluded from page* 183.)

The question of the geographical diffusion of quinquinas, and of the general laws which seem to govern it, has been justly regarded as one of the most interesting points of their history. The traveller who lands on the coasts of Peru, after having visited the eastern shores of South America, is very forcibly struck with the difference of their aspect. Instead of that luxuriant and uncultivated vegetation which the Atlantic washes at all parts, the eye meets, on the greater part of the flat shores of the Pacific, with nothing but sterility, reefs, and inaccessible heights. Everywhere that the hand of man has not intervened, nature seems to have refused to produce.

In proportion as we advance from the coast to the interior, the ground rises, and gradually, the mean temperature diminishing on account of the elevation, alpine plants are observed to succeed to the tropical vegetation and that of the temperate regions; then the crest of the Cordillera being crossed, we find ourselves on vast plains or *punas*, whose level is often higher than the highest mountains of Europe.

In all these regions, no forest occurs: one may travel for days, for whole weeks, without meeting with a tree of spontaneous origin. To the east of the *punas* rises the second

* *Journal de Pharmacie.*

Cordillera, recognisable at a distance from its snowy peaks. The eastern portion of the chain then lowers suddenly towards the forest region, then, less precipitately, and its last eminences end in the distance by being confounded with the undulation of the plains of the interior.

Innumerable rivulets take their origin in the snows of these heights, and flow down their rapid declivity; these are the first sources of the principal rivers of the continent. Each of these sources is at first only a thin stream of milky water, which falls from rock to rock, or winds in the midst of small tufts of Arctic plants. Further on, by the addition of new streams, the rivulet becomes a torrent, which opens a deep bed in the flank of the mountain, and still farther, the re-union of several of these ravines forms deep valleys, enclosed by banks of several hundred feet in height. Now, it is on the vast eminences which separate these valleys from each other, that the quinquinas grow in the midst of thick forests. Their region commences with the high forest vegetation of the mountain side—it terminates at a little above the level of the plains.

Although these details relate only to Bolivia and Peru, they apply equally to other parts of cinchona countries. The country which has just been described forms an immense strip, interrupted only in some points, and occupying almost constantly the eastern portion of the second Cordillera in the points where the latter retains its usual elevation. These Cordilleras form, so to speak, on account of the immense elevation of the valley which separates them, only one and the same chain, whose western portion is deprived of forest vegetation throughout the greater part of its extent, owing to the absence of sufficient irrigation. Where these conditions change, the cinchonas appear. Towards the latitude of Loxa, for example, where the second Cordillera lowers, the cinchoniferous region immediately quits the limits in which it was confined and approaches the sea. Near the equator, where the western portion of the Cordillera nearest the sea is covered with forest vegetation, cinchonas are also seen.

The forests in which are the quinquinas present to the eye all that totality of majestic forms—those brilliant colors in which it is customary to paint nature in the tropics; the trees, the plants which grow in company with the cinchonas form the greater part of the vegetable productions of Western America—a climate which produces at once corn and maize, the sugar-cane, banana, cotton, and cocoa. With the exception of the inequality of the earth, Dr. Weddell found much general resemblance between the ipecacuanha forests of Matto-grosso and those in which he studied the quinquinas, in some parts of Bolivia and Peru.

The region inhabited by the present cinchona genus occupies in latitude an extent of about 29 degrees. It represents a narrow slip, more or less sinuous, describing a vast curve, which follows the direction of the great Cordillera of the Andes, setting out from 19° south parallel, and corresponding in general to its western portion, where it is maintained at a height which varies a little according to the latitude, but which is continued between the extreme limits of 1,200 and 3,270 metres. The middle of this curve, which is at the same time its most western point, and that nearest the shore, is situated towards Loxa, on the 82nd degree of west longitude from Paris; its lower extremity touches the 62nd degree, and its upper extremity enters the 70th.

From among the quinquinas described in Dr. Weddell's magnificent monograph, we select some new species which appear to us of great interest. The most important is that to which the author has given the name of *Cinchona calisaya*, and which he characterises as follows:—

C. foliis oblongis vel lanceolato obovatis, obtusis, basi attenuatis, rarius utrinque acutis, glabratis, nitidis vel subtus pubescentibus, in axillis venarum scrobiculatis; filamentis quam dimidia anthera plerumque brevioribus; capsula ovata, flores longitudine vix æquante; seminibus margine crebre fimbriato denticulatis. HAB.: *Bolivia et Peruvia Australis.*

This species is the most valuable of all the barks employed in therapeutics, and which has always been known in commerce by the name of *Quinquina Calisaya*, and whose origin has hitherto been unknown in a botanical point of view. This tree was heretofore found in Peru, only in the southern part of the province of Carabaya. Dr. Weddell has found it in several other more northern provinces, as far as the confines of the valley of Sandia, where its production suddenly stops. The high reputation of *Quinquina Calisaya* has caused it to be so much sought after that it is becoming extremely rare, and there is no doubt that one day it will almost entirely disappear from commerce, and that we shall finally be compelled to content ourselves with other kinds which we at present despise.

The pre-eminence of *Quinquina Calisaya* over all other cinchona barks, dates particularly from the works of Pelletier and Caventou; this pre-eminence was formerly shared with the quinquina of Loxa, which is

now comparatively valueless. It is known, indeed, that the latter contains little else than cinchonine, whilst the Calisaya contains only a small proportion of it, and furnishes as much as 30 and 35 per 1,000 of sulphate of quinine.

The scarcity of *Quinquina Calisaya* perpetually induces the *cascarilleros* to mix with it the barks of several other cinchonas, and they succeed the more readily in this fraud, as we are almost accustomed to it, and as none but the very skilful can, without difficulty, detect it. The mixture is made particularly with the barks of *C. Boliviana* and *C. Ovata*, and with those barks which M. Guibourt so justly calls the *light calisayas of commerce*. The best characters for distinguishing the true calisaya are, the shortness of the fibres which cover the entire surface of its transversal fracture, the ease with which they are detached, instead of remaining adherent, its uniformly fawn color, not marbled with white in its thickness. Add to these characters its density, which is so great that scraping with the nail on its inner surface commonly leaves a shining mark, the depth of its *conchas*, the salience of the crests which separate them, and we shall almost always be able to distinguish the flat calisaya from all the other barks with which it might be mixed.

For a long time writers on materia medica have attributed the *Quinquina Calisaya* to the *Cinchona Cordifolia*, being deceived, doubtless, by the designation of yellow quinquina, which was given by Mutis to the bark of this tree. M. Guibourt was the first who did justice to this error, and, guided by the authentic samples of quinquinas of Mutis, brought by Humboldt, he was enabled to decide that it owes its origin to the *C. Lancfolia* of the same author. The true source of *Quinquina Calisaya* still remained in no less obscurity.

An idea may be formed of the immense consumption of this bark from the fact that the Bolivian Company annually exports, including adulterations, 200,000 kilogrammes of it. It is difficult for the forests long to supply such demands. The quantity of bark furnished by a *Cinchona Calisaya* necessarily varies much. One of the finest trees may give as much as six or seven arobes,* weighed after desiccation. A tree of ten metres, with a trunk of two decimetres in diameter, yields scarcely nine or ten kilogrammes. The Company of Paz buys it, on the average, at the rate of 20 piastres (£4.) the arobe, delivered at its depôts, and in the neighbouring province of Carabaya, in Peru, where no monopoly exists, it pays 40 piastres. On the coast, the price of the calisaya is nearly double that sum.

The characters which Dr. Weddell assigns to *Cinchona Australis* are the following:—

C. foliis late ellipticis vel obovatis, obtusis, basi acutis, utrinque glaberrimis, nitidis, subtus in axillis venarum, venularumque minute, scrobiculatis; capsula ovato-lanceolata, sursum insigne attenuata; ala seminum margine setoso denticulata.

This species has at present been discovered in only two localities, situated at about 20 leagues to the south of Santa Cruz de la Sierra. This kind is furthest from the equator and nearest to the southern limits of the tropical regions.

Finally, we likewise notice the *Cinchona micrantha*, to which Dr. Weddell applies the following characteristic phrase:—

C. foliis late ovatis, obovatis rotundatisve obtusiuscalis, basi plus minus attenuatis, membranaceis, supra glabris, subtus lævissime puberulis, in venis et axillis suis pubescentibus vel pilosis; dentibus calycinis brevibus, acuminatis; panicula thyrsoidea, fructifera subconferta; capsula lanceolata; ala seminum margine denticulata.

* The arobe is equivalent to 11½ kilogrammes.

ON CERTAIN EFFECTS OF AN INVETERATE HABIT OF SMOKING.—THE DENUDATION OF THE PERIOSTEUM OF THE FANGS OF THE TEETH.*

BY J. L. LEVISON, ESQ., BRIGHTON.

PERMIT me to call your attention to the fact that extreme smokers often suffer greatly after the habit has been intemperately indulged in, particularly with the teeth, which are found to be denuded of the periosteum of the fangs. In order to render the subsequent statements and inferences appreciated, we may remark that tobacco is ranked, by writers on toxicology, among the narcotic poisons—that it is injurious to the digestive organs, &c. You will, therefore, not be surprised that the teeth should suffer from the use of this narcotic, because they are sympathetically affected under every form of dyspepsia, whenever, in consequence of such disturbed functions, there is an access of acidity.

It is my intention, therefore, to attempt to explain why tobacco induces a double injury when used for smoking, either in pipes or cigars.

The phenomena attending the process of combustion may be observed as follows:—That during the time of its burning, there is

* *Medical Times*, Jan. 12, 1850.

given off a white smoke, which contains some small portions of the essential oil of the tobacco, which, as being a concentrated portion of the narcotic agent, affects the teeth; and some of it, mixing with the saliva, if carried into the stomach, induces derangement of that important organ,—consequently, smoking tobacco is likely to affect the health of the teeth in a direct manner, and, indirectly, as a cause of morbid conditions of the stomach and the auxiliary agents of the vegetative functions,

As evidence of my first statement, it may be remarked that smokers are subjected, occasionally, to agonising pain in their teeth, even when there do not appear any symptoms of dyspepsia. In these cases, the crowns are often sound, but the enamel, instead of being a beautiful polished, white, opaque substance, as in its normal condition, presents a translucent and vitreous appearance, whilst the edges of the incisors are often transparent. That we may attribute these changes to the cause previously stated, arises from the fact that this is the ordinary aspect of the enamel in great smokers. The color and appearance cannot be confounded with the dark shades given to this substance whenever the subjacent dentine is carious. We have seen numerous well marked instances in persons who have smoked clay pipes, or meerschaums, or cigars, the effect being the result of the heat given off whilst the tobacco is burning. It should be remembered that the average temperature of the mouth varies from 88° to 95° of Fahrenheit's thermometer. It might have been *à priori* inferred that streams of smoke, at such an elevated temperature, could not be harmless. Besides which, the stimulating influence of the heated smoke excites the action of the salivary glands, producing an excess of the fluid, which, after a time, ceases, and a less than sufficient quantity of saliva is produced; and, when such is the case, the smoker desires something "to wet his mouth"—and hence the habit of drinking stimulating beverages is the ultimate consequence.

In a vast number of cases of extreme smoking, when those who have indulged in such excess have had what has been called toothache, their sufferings have been great, yet, in most of the instances, I have observed that the crowns of the affected teeth seemed perfect, excepting that the enamel appeared to be altered in structure and color (as already mentioned), and, therefore, I directed my especial attention to the state of the fangs, and found them, in all such instances, denuded of their periosteum, being rough at the extremities, as if rasped, whilst the color of the fangs themselves resembled horn, being of a darker hue than healthy dentine, and of a porous appearance, differing materially from the usual dense substance which envelopes them, and which substance is designated crustapetrosa. In consequence, therefore, of the active absorption going on, the affected teeth act as extraneous bodies, and produce much local irritation.

Hence, from the data of this kind, I am led to the inference that tobacco affects the teeth themselves, and that the affection must not be confounded with their injury, induced by the acidity often caused by stomach derangement, resulting from an inveterate habit of smoking tobacco. There is nothing speculative in these statements. Their truth has been verified by years of experience. The symptoms are well marked in the "smoker's disease." They are as follow:—More or less uneasy sensations about the crown of the tooth, which gradually extends to the fangs. At this stage of the disorder, if the teeth are touched, there is a tenderness experienced; and if bitten on in this condition, a sudden and most painful sensation is occasioned. As the disease proceeds, the patient seems cognisant of the immediate seat of the disease; the agonising pain being confined to the bottom of the alveolar process of the affected tooth or teeth, which is attended with a palpable throbbing, or, as an unscientific sufferer expressed it, "a jumping pain." The most distressing sensations are felt under vicissitudes of climate—in great or sudden changes from heat to cold—or *vice versa*; or, after drinking spirits and water, wine, beer, or any other alcoholic stimulants. In other words, the teeth, under this affection, suffer from everything that accelerates the circulation.

Among many of my most intelligent patients, when there happened to be a space (from previous extraction) between the affected teeth, they have described their sensation as if a series of galvanic or electrical shocks continually passed from tooth to tooth; and tired at last by this continued disturbance, they have had the offenders forcibly removed.

It is, therefore, very evident, that when so much suffering results from teeth that are not carious, we may safely attribute the pain to the fact, that with the loss of the periosteum, the fangs lose their normal vitality; and that the local irritation arises from the fangs acting as a foreign body.

We are further prepared to explain when teeth are thus injured by the action of hot fumes of a powerful narcotic poison, that they are rendered, in consequence, more suscepti-

ble to any other kind of destructive agency. Among the causes which tend to expedite rapid changes must be mentioned dyspepsia, in which disease the saliva is more or less acidified, and the smokers' teeth are acted on so much more potently. For, when the teeth are healthy, they, like all organic substances, can resist, to a certain degree, the action of corroding agents; but when they no longer retain a normal vitality, their decomposition follows.

The case must be thus briefly stated—that the injury of the teeth in inveterate tobacco-smokers is induced by a two-fold operation; 1st, the fangs being denuded of their periosteum must be regarded as extraneous bodies, and are then acted upon most energetically by the absorbents; and, 2ndly, when such is the case, the teeth are liable to be acted on by acids in an inverse ratio to the loss of vital action. Finally, these two causes enable us to account for the transparent appearance of the enamel in the teeth of smokers; as this appearance is a simple result of the rapid loss of the earthy matter. We may add that there appears to be a well defined difference in the diseases of the teeth, resulting from stomach "diseases *per se* and the smokers' disease." In the first species the gums are spongy and full, or else they recede from the necks of the teeth, and by exposing the alveolar processes, subject them to absorption. Then the denudation of the periosteum commences at the necks of the teeth and caries is the consequence. But in the "smokers' disease" these processes are reversed, the hot smoke affects the fangs in the first instance, without in any serious way affecting the crowns; so that the horrid pain does not arise from exposure of the pulp cavity (as in ordinary caries), but from the roughened state of the denuded fang or fangs keeping up constant irritation.

ON SANTONINE, AND ON ITS PREPARATION BY M. GAFFARD'S PROCESS.*

BY M. CALLOUD, OF ANNECY.

I BEG that my honorable colleague will see in the discussion which I open on his work only a desire of arriving at the truth. Perhaps my observations will appear of very ordinary interest, in a general point of view; but we are treating of those practical questions whose perpetual application renders the most minute details of real importance to the pharmaceutist and physician.

Moreover, I am occupied in ascertaining accurately the chemical characters and medical value of the various products of the analysis of semencontra, but these minutiæ require much time.

Returning to the principal object, I may remark that, at the conclusion of a short paper, published in the *Journal de Pharmacie* for February, 1849, I manifested a desire to submit to a chemical and therapeutical examination a resinoïd matter free from santonine, and retaining the odor and taste of *semencontra*.

Every practitioner is aware that many substitutes for santonine have been tried, the same as for quinine, but with more success; many medicaments have been found which, without containing santonine, possess the property of expelling from the body lumbricæ, as that digusting fucus, Corsican moss, the acrid purgative bitters, the fatty and volatile oils, garlic soup, and, in the first rank, the unblown flower of Barbary semencontra—*Artemisia Judaïca*.

It would not, then, be astonishing that, in M. Gaffard's complex santonine, the matters which remained associated with the santonine had their share of activity; however, in this very case it will always have against it color, odor, bitter taste, and, which deserves particular attention, santonine, for it is with this vegetable as with the quinas, all these barks are not equally rich, and the more or less inert substances are contained in them, on the contrary, in greater quantity in some than in others.

In order to arrive at an accurate appreciation of the medical power of the complex santonine, and of the elements which are associated with it, I have just operated on several kilogrammes of semencontra, in order to have sufficient of the products to give to several physicians, who will judge of their merit from numerous trials.

M. Gaffard recommends not drying his santonine completely, *in the fear of volatilising the essential oil.*

Not being able to suppose that, after an hour's boiling, any could remain, I submitted to distillation 500 grms. of semencontra, with the proportions which he indicates, fractioning the product, the first flask after 20 minutes, the 2nd and 3rd after 15 minutes each, and the 4th after 10 minutes; the first contained three-fourths of the oil, the second and third one-fourth, and the fourth only some very minute drops.

I terminated the operation according to the author's directions.

M. Gaffard not having spoken of the acid mother liquor, I neutralised them by my own method.

From the acid liquid of 2 kilogrs. of semen-

* *Journal de Pharmacie*, Dec., 1849.

contra, I extracted 2 grammes 25 centigrs. of santonine, constituting, to the prejudice of its active residues, a loss of 9 per cent. of the 28 grammes contained in the 2 kilogrammes.

In the various trials which I have made, I have observed in the deposits of the decoction a paste of earthy appearance (which I shall hereafter examine) which is not presented in operating with lime, thinking that the half caustic potassa might alter the vegetable organisation, and, consequently, the santonine; to determine this, I boiled four grammes of santonine, for one hour, in a quart of water containing potassa. It remained unaltered, except that it was slightly colored.

64 grammes of complex santonine were treated by the ammonia process, in order to separate the santonine and the resinoïd matter. What was my surprise, after many attempts, at being able to separate only part of the active principle, whilst the ammoniacal liquors carried away fatty matter, resinoïd matter, and santonine.

I was enabled to recover all the santonine only by treating the whole with a sufficient quantity of milk of lime.

By means of cold ether I proved that it contained much fat oil saponified by the ammonia; it prevented the desired separation.*

Being convinced that it can only be the resinoïd matter and bitter fat oil which can second the effects of santonine, from what M. Gaffard has said, I have endeavoured to isolate this oil. Experience having taught me that the residues of operations still contained much of it, especially that by lime, I took half a kilogramme of this latter, which I boiled twice, with four quarts of alcohol and I distilled; there remained in the sand-bath a green butyraceous matter, containing wax and green resin, substances noticed by authors; and by means of cold ether, I separated 15 grammes of green oil, having the same color and bitterness as that obtained from complex santonine.

Authors do not mention (san *furreur*) a canary yellow oil; it is obtained by acting with cold ether on the residues of semencontra obtained by the two processes; it must be this oil that gives the yellow color to the seed.

Being desirous of ascertaining what M. Gaffard's method would give with semencontra exhausted of santonine by lime, I subjected half a kilogr. of it to the action of his potassa water; I obtained 15 grammes of black odorous matter; by means of ether I extracted from it 3 grammes of fat oil. The remaining portion was tasteless.

As the semencontra of Barbary enjoys a reputation as a vermifuge, I desired to investigate it again, and was unable to discover any crystallisable principle. I am desirous of having the seed of this plant in order to be better able to judge; the flower was subjected to the treatment and the same principles, with some slight modifications, were found in it.

I may be permitted to say a few words on pure santonine and on the doses in which it should be administered. For the last seven years I have employed it in lozenges, four of which contain 5 centigrs. 50 milligrs. My sale often exceeds 3,000 in a year, and more than 500 doses, containing each 5 centigrs. mixed with sugar, administered in two or three teaspoonfuls of sugared water, from the age of ten months to one or two years. Those who raise the dose, at the age of eight years, to 10 and 15 centigrs. in one day, run the risk of cholic. Five centigrs. of santonine are equivalent to 4 grammes of semencontra.

M. Gaffard says that his lozenges contain 2½ centigrs. of santonine; this, doubtless, is a mistake of the press for 2½ milligrs. Besides, he does not give the proportion of his product to the semencontra employed; but I have found 100 grammes per kilogr. which should also contain, as the kilogr. of semencontra, about 14 grammes of santonine. In his formula he puts 12 grammes of complex santonine, or 0·14 of pure santonine to 500 grammes of lozenges, at 1·15 gramme the lozenge, which should make about 3½ milligrs. that it contains. Is this an error in copying, of calculation, or of analysis? If there is no error, he must have used a very poor quality of semencontra, and this shows the uncertainty of the medicinal value of these lozenges, or that he suffered an enormous, and absolutely improbable, loss of santonine.

His lozenges should contain 3½ milligrs. each. At from one to two years he gives, four times a day, 3 lozenges, in all 12 lozenges, or 42 milligrs. of santonine, nearly the same dose as I give; but it appears from his statements that he is in the habit of giving larger doses, which confirms my opinion that in his complex santonine there is

* At the period of the discovery of black and white emetics, I turned my attention to it, and from that time I applied to ipecacuanha in powder, cold rectified ether, which freed it from its very repulsive fatty oil, without touching the essential principles of that valuable medicinal substance. The physicians of this city have prescribed it for delicate persons with as much success as ipecacuanha not deprived of its fixed oil.

no other active principle than in mine, santonine exclusively, even taking into the calculation the loss of santonine which must take place.

To decide the question by direct experiment, I prepared lozenges of complex santonine according to M. Gaffard's process, and I simultaneously prepared some with 8 grammes of dried resinoïd matter obtained from the ammoniacal liquor (lime process), 1,152 lozenges, each containing 7 milligrs. of this substance; with 2 grammes of fatty oil I made 576 lozenges; and after having also prepared some complex santonine from the Barbary semencontra, I made with 8 grammes 1,152 lozenges, and I have requested several physicians to be kind enough to use them, and we shall hereafter hear with what result.

According to my experiments, and awaiting the last results of comparative experiments which are in course of being made as to the vermifuge effects of the various elements associated with santonine, I think I may say with regard to M. Gaffard's process, as to economy for the manipulator, it appears to me to be very trifling with respect to the work, since the most disagreeable material part is finished, the operations with ammonia and alcohol, which are not very troublesome, alone remaining to be performed.

It is perfectly insignificant with regard to expense; from 5 to 10 francs are saved, following the course of ammonia and alcohol, and for a very trifling consumption, in a kilogramme worth 450 francs (£18) it is about 2 per cent. Besides, by neglecting the acidulated liquor, he loses 2·25 grammes of santonine out of the 28 or 29 grammes contained in 2 kilogrs. of semencontra—namely, 8 or 9 per cent., which augments by so much the loss of his product with regard to its medicinal value.

As to economy in favor of patients, it must be borne in mind that the lozenges prepared are still very repugnant to the taste. Now, people of small means, to whom the inconvenience of taste is a secondary affair, may with still more economy take semencontra in its natural state.

With respect to the physician who prescribes the remedy, he does not know better than if he had employed semencontra in its natural state the quantity of active principle which the remedy contains according to the richness of the semencontra employed in its preparation.

Finally, in a scientific point of view—

1. The substitution of potassa for lime has no other effect than to leave the bitter fat oil and the resinoïd matter combined with the santonine, for there remains no essential oil in the product, at the point of reduction to which it is brought. Moreover, this essential oil would not be more efficacious than that of turpentine, and, besides, its odor is so repulsive that it can be put into the lozenges only in infinitesimal and, consequently, useless doses.

2. The employment of potassa disposes the bitter fat oil to be saponified by the ammonia, so that the santonine can no more be separated from it.

3. In semencontra there is a yellow fat oil, which I do not think has been noticed before by operators.

Moreover, the German authors of the discovery of santonine are very probably in possession of a more simple process, and obtain much more beautiful results.

They work the semencontra in masses which are rather astonishing; two druggists of Geneva sent to Genoa in 1848 more than 26 kilogrs. of santonine. These quantities show how much pure santonine has been generally appreciated, and how its employment has been extended everywhere, as within the sphere of my own practice.

ACTION OF LIME ON ANIMAL AND VEGETABLE SUBSTANCES.*

BY JOHN DAVY, M.D., F.R.S.

On the Action of Lime on the Textures of the human Body.—It is commonly asserted and believed that lime exercises a corroding, destructive influence on animal matter in general, and that animal matter in general, and that animal bodies exposed to its action rapidly decompose and disappear. Accordingly, it has been almost invariably recommended to add this earth to graves, in instances in which a rapid decay is considered desirable, as on the occasion of the crowding of grave-pits with dead bodies during the prevalence of pestilential diseases. From the results of many experiments which I have made with lime on animal substances, I have been compelled to come to the conclusion that this opinion is not well founded in fact; indeed, that it is altogether erroneous.

The experiments were commenced in Malta, in the summer of 1829, and they were carried on during the following year. The method observed was to immerse the animal matter for trial in cream of lime, or rather a paste of lime, contained in a wide-mouthed bottle, well corked and covered with cerate cloth, to exclude the ingress of

* *Jameson's Edinburgh Journal*, January.

atmospheric air, and to preserve the lime in its caustic state.

One of the first experiments tried was commenced on the 27th of August. Portions of various textures were immersed, as mentioned above. They were taken from a subject in a state of incipient putrefaction, and they inhaled a fetid smell. On immersion in the lime and water, as might be expected, they gave off a strong ammoniacal odor. They were first examined on the 24th of September. They were then all in excellent preservation, swollen but not corroded, nor their delicate tissue injured. They were next examined seven months after, viz., on the 5th of May, of the year following. The report was equally favorable. It is stated that they were much in the same state as before, the texture of each part distinct, and the part, as a whole, easily distinguishable. They were left undisturbed nearly two years, until the 6th April, 1832, when, on examination, they were found to have undergone material change. The cuticle had become soft and transparent, as had, also, the dura mater, admitting of being torn with the greatest ease. The muscle appeared to be converted into adipocire, which was quite white, had no unpleasant smell, was friable when dried, and burned with a bright flame, without any unpleasant smell. The other parts were not distinguishable. Most of the lime was converted into carbonate of lime, atmospheric air not having been entirely excluded.

The second experiment recorded was commenced in the beginning of October. Portions of aorta, dura mater, intestine, skin, cellular tissue, muscle, and tendon, were similarly treated. The results were examined on the 5th May following. Then, on opening the bottle, an ammoniacal, but no putrid, smell was perceptible. The parts were found well preserved, excepting the fatty matter contained in the cellular tissue, which had become of an opaque white, and friable, from combination with the alkaline earth, and conversion into soap. The tendon, it is mentioned, was somewhat distended, and rendered more transparent but not gelatinised; and so, also, in a less degree, were the dura mater and cutis; and the last was deprived of its cuticle and hair.

Some other experiments were made; but, as the results were very similar, it would be tedious to describe them. I may state, generally, that, with the exception of cuticle, nail, and perhaps hair, lime exerted on the different textures on which it was tried no destructive power, but a contrary influence, and more particularly a well-marked antiseptic one. It has been stated how certain parts, in the first experiment, lost the putrid odor which they had acquired when immersed in lime and water. Moreover, it appears from notes of experiments that after animal substances have been fully subjected to the action of lime, they ceased to be putrescent: they resisted putrefaction, whether placed in air or plunged and kept in common water. I shall mention one instance. On the 13th of May, 1830, a portion of ileum, with mesentery attached, and a portion of the muscular part of the heart, with the chordæ tendineæ, were placed in a large jar of transparent lime-water, and covered with cerate cloth. Examined nine months after, on the 16th of February, they were found in good preservation, and without any putrid or unpleasant odor. The only change perceptible was that the portion of heart and intestine had acquired a light greenish hue, and the tendon an opalescent hue; and all were a little softened. A crust of carbonate of lime had formed on the water, which still retained some caustic lime. They were then transferred to a jar of common water, where, after four days, they continued unaltered. I may add that a portion of cutis, similarly treated, placed in confined air in a bottle, after a whole month emitted no unpleasant odor, and appeared to be unchanged.

I have observed that cuticle, nail, and perhaps hair, are to be excluded from the list of animal substances, not materially altered by the action of lime. On the cuticle its action is powerful; and, I apprehend, in consequence of a chemical combination between them being formed. It is well known how lime has the property of rendering the cuticle easily separable over the cutis vera, and how, in the art of tanning, it is applied to this purpose. The human cuticle—that, for instance, of the sole of the foot—I find become soft and gelatinous from immersion in lime and water. After drying, a portion thus tried (well washed previous to drying) was white, semi-transparent, and brittle. Incinerated, it yielded 17 per cent of ash, which consisted principally of lime and carbonate of lime.

The effect of lime on nail is similar to that which it exercises on cuticle, but not so strongly marked. A portion of nail of the great toe, macerated in lime and water, from the 7th of June to the 18th of August, was rendered soft and friable, a little swollen, and disposed to separate or break up in layers. Dried, it exhibited the same character as cuticle; and when incinerated, burned in a similar manner, and left a considerable ash, consisting of a small pro-

portion of phosphate of lime, which pre-existed in the nail, and a large proportion of lime, with which, during the change from maceration, it may be inferred it combined.

On hair the effect of lime appears to be more destructive; but in what manner it acts I have not attempted to ascertain. A portion of human hair of the head, which had been kept in lime and water about three months, was partially decomposed. At the bottom of the vessel there was a little black sediment. The hair, which was black, had acquired a just perceptible reddish shade, and had become much finer, as if wasted, and more friable, so as to be easily broken.

Relative to the results of the experiments generally, they appear to me to bear me out in the remark with which I prefaced them, —viz., that lime does not exercise a destructive corroding power on animal substances generally, nor one promoting their decomposition; but, on the contrary, a preservative and decidedly antiseptic power, arresting putrefaction even when commenced, and retarding decomposition. What new arrangements of the elements of animal matter may take place under the influence of lime is a subject for further inquiry. Probably the effects of lime on cuticle, nail, and hair, on which, in the arts, its operation has been best known, led to the ideas of its agency on animal substances generally, which I have been under the necessity of combating.

On the action of lime on vegetable substances.—Reasoning from analogy, from what I had witnessed of the effects of lime on animal substances, I was induced to question the views which are commonly entertained of the operations of this earth on vegetable matters, as its supposed power of facilitating their decomposition, and promoting their fermentation and solution. And the few experiments which I have made have more than confirmed me in my doubts.

As the subject is of very great importance in relation to agriculture, I shall describe the results which were obtained, using small quantities as most manageable, and best accordant with my limited means; hoping that my statements may induce others to repeat the experiments on a large scale, and extend them in a manner befitting the consequences involved.

The experiments were commenced in June 1836, and they were concluded in November, 1838. I shall describe them individually.

On the 27th of June, 1836, one portion of sawdust, I believe of Norwegian fir, was put into a bottle, with distilled water and quick lime (the bottle was about half filled with the mixture), and corked.

Another portion of sawdust was put into a bottle with water and corked, but without the addition of lime.

Examined on the 1st November, 1838, the sawdust, with the lime, had no appearance of any material change; its colour, perhaps, was a little heightened; the water only just perceptibly colored; it had a strong taste of lime, evaporated to dryness, it afforded a light yellow residue, consisting chiefly of lime; the proportion of vegetable matter was hardly appreciable.

The other portion, examined after the same interval, also exhibited very little change. A mucilaginous film had formed over the submerged stratum of sawdust, too delicate and small in quantity to be collected and examined in a satisfactory manner; the sawdust retained its color, and the water was colorless. The water evaporated to dryness, yielded a very minute brownish residue, slightly bitter, which had no effect either on litmus or turmeric paper. No smell was perceived on opening the cork of either bottle.

On the 17th June, 1836, some clover leaf and flower, and some leaf of the common mallow, were put into a bottle with quicklime and water; the bottle was corked, and the cork was covered with sealing-wax. The quicklime used was tested for carbonic acid, and found to be perfectly free from it, not effervescing in the slightest degree in dissolving in an acid. For comparison, two other mixtures were at the same time made of the same vegetables and water, and bottled, one of which was corked, being about half full of air, the other was not corked; a little cotton wool was merely put into the mouth of the bottle to exclude dust and prevent evaporation.

Examined on the 1st November, 1838; the mixture with the lime appeared to be but little altered; the leaves and the flower retained their form; the former were of a bright fresh green; the latter had become brown; the water was colourless; the lime had acquired a light greenish hue; it dissolved in dilute muriatic acid, without giving off a particle of carbonic acid gas. The water evaporated yielded but a small residue, consisting chiefly of lime. The leaves and flowers, though they retained their form, yet, when shaken in the bottle, were broken into small pieces, and the leaflets detached. Farther, it may be remarked, that the smell perceived on drawing the cork was similar to that of bruised clover.

The other mixtures, to which lime had not been added, exhibited different results. That

which was corked, a portion of air included, examined on the 4th November, 1838, appeared much altered: there was at bottom a light greenish sediment; at top an almost black mass; and, suspended in the water intermediately, were the small flower-leaves, almost colorless. The water was greenish; and, when evaporated to dryness, yielded a small brownish extract; the leaves were in a pulpy state, and disorganised. The smell from the mixture was offensive, not unlike that of clover fermenting.

The mixture from which air was not excluded fermented soon after it was put by. Ten days after, namely, on the 27th June, it was noted that the vegetable matter was rapidly decomposing with a very offensive odor, approaching to that of the putrid; that much gas had been disengaged, and a good deal of sediment had collected.

Examined on the 2nd November, 1838, it was found in a state very similar to that last described, bearing marks of advanced decomposition.

An experiment similar to that on the mallow leaf and clover was made with lime and water, on moss and lichen, and with a very similar result. It was commenced on the 23rd June, 1836, and terminated on the 1st November, 1838. The moss and lichen retained their form, and bore being shaken in the bottle without falling to pieces. The water had acquired a light greenish hue; the lime a brownish hue. The water evaporated afforded a small brownish residue, consisting chiefly of lime.

I shall mention one experiment more of the same duration, in which clover leaf and flower and mallow leaf were put into a bottle covered with hydrate of lime, and the access of air excluded by a cork and sealing-wax. Examined on the 2nd November, 1838, the flower was found brown; the clover-leaves of a very light green; the mallow of a dark green, and all very friable, falling to pieces when touched. The lime was examined both before and after for carbonic acid, and it was quite free from it at the commencement of the experiment, as it was also at the conclusion: it dissolved in an acid without the slightest effervescence, and appeared to be quite unaltered.

These results appear to me conclusive that lime does not promote the decomposition of vegetable matter; and, as I have before mentioned, that instead of promoting, it arrests its fermentation. The circumstance that no carbonic acid could be detected in the lime after having been in contact with vegetable matter, both with and without water, I apprehend may be considered as demonstrative on this point.

Whether lime has any solvent power on vegetable matter, apart from the supposed one of exciting fermentation, is a distinct question. From what I have witnessed in carrying on these experiments, I infer that it has, in a slight degree at least, in combination with water. The extract obtained by evaporating the lime-water which was in contact with the vegetable matter was, perhaps, indicative of this, especially in the instance of the sawdust, as was also the softened state of the leaves and flowers, falling to pieces on being shaken; and confirmation, perhaps, is afforded in the results of two comparative experiments made on the same leaves and flower, with magnesia and water, and a solution of carbonate of potash (the old subcarbonate). Both mixtures were made on the 23rd June, 1836, and they were both examined on the 4th November, 1838. There was a marked contrast between them. The leaves and flower with the magnesia water retained their form unaltered, and their texture did not appear to be materially weakened: they bore being shaken in the bottle without falling to pieces, and the water was only just perceptibly colored greenish, and the magnesia brownish, the leaves retaining their color unimpaired. The leaves and flowers, on the contrary, in the alkaline solution, were reduced to small pieces, and seemed to be wasted and deprived very much of their coloring matter, and in a pultaceous state; the solution was of a dark olive green: evaporated, it yielded a residue abounding in coloring matter. Lime in its solvent power is probably intermediate in degree between magnesia and the more active alkali, more active even in combination, with one proportion of carbonic acid, than the magnesia, or even lime in a caustic state.

The application of the preceding results to agriculture, in relation to manures, I must decline discussing. The subject is one of too much importance, and magnitude, and difficulty, to be lightly entered on.

ON THE EMPLOYMENT OF ACETATE OF LEAD IN THE TREATMENT OF SCROFULOUS TUBERCLES.*

BY M. LE COUPPEY.

Are scrofulous tubercles and pulmonary tubercles identical? This question divides the medical world, and whose peremptory decision is wanting to the certainty of therapeutics. I have thought that the solution of

* *Comptes Rendus*, No. 27; Dec. 31, 1849.

the problem might be found in the consideration and practical researches briefly detailed in the memoir which I have the honor of submitting to the judgment of the Academy.

In my opinion, the tubercles form a kind of animalcule approximating to the *monades*, and which might be designated under the name of *monoïdes*. The pulmonary tubercle, *monoïdes pulmonalis*, and the scrofulous tubercle, *monoïdes strumosus*, constitute two distinct species. Examined with the microscope, one is globular; the other, on the contrary, polyhedral, and, besides, infinitely smaller. The pulmonary tubercle and the scrofulous tubercle present no less characteristic differences in their vital force; they are subject in the same manner to the impression of pharmaceutical agents. Indeed, on one hand, the mercurials, which are inefficacious, in the treatment of strumous swellings, annihilate pulmonary tubercles, as established by my note on the curability of phthysis, read at the sitting of the 6th of August last.

On the other hand, preparations of lead, which are almost insignificant in phthysis, destroy scrofulous tubercles, or, in other terms, cure with marvellous facility strumous swellings of the lymphatic and subcutaneous glands, which are known to be rebellious to all modes of treatment hitherto employed. The truth of this assertion seems to me to be put beyond doubt by the observations given in my memoir. From these observations, in fact, it results that crystallised acetate of lead, administered internally, in the dose of from 2 to 20 centigrammes per day, cures tuberculous swellings of the subcutaneous lymphatic glands. The same facts show, moreover, that purgatives favor the therapeutical action of the medicine, presenting the double advantage of accelerating the revolution of tumors and of preventing poisoning by lead.

SUMBUL.*

In recently attending the medical wards of King's College Hospital, we perceived that Dr. Todd was prescribing, in a case of epilepsy, a medicine, the name of which we heard for the first time. On inquiry, we find that this root, called Sumbul, is being introduced into practice as an anti-spasmodic, by Mr. Savory, of Bond-street. It appears that Dr. Granville, on a recent return from the Continent, mentioned sumbul to Mr. Savory as a root employed with great success in Germany and Russia against cholera; wondering that it had not yet found its way into this country. Mr. Savory immediately set about procuring it, but his correspondent in Russia had much trouble in getting the root; he, however, sent over specimens of it.

A little later, another parcel of the Sumbul was obtained, by the same house, from Hamburg; and on comparing the two samples, Mr. Savory came to the conclusion that the German one was decidedly the firmest, least damaged, and in the best condition of the two. We were shown these specimens, and find that they resemble much the circular pieces in which calumba is generally seen, except that they are considerably larger, of a more spongy texture, and resembling huge bungs. They are of a yellowish grey, whitish in the centre, with a thin pellicular bark surrounding them. The most striking feature of the root is its very strong odor, which very much approaches that of musk, being almost as pleasant and powerful. The pieces are very light, and seemed to be formed of a condensed and hardened pithy substance. From this imperfect description, it may at once be gathered that the Sumbul promised to be useful as an anti-spasmodic, and Mr. Savory first thought of combining it with the cotyledon umbilicus, and using it against epilepsy. It is, however, being tried by itself; and although Dr. Todd cannot as yet state anything positive as to results, we were told that the little boy who is taking ten minims of the tincture thrice a-day, and who, when admitted, had an epileptic fit once or twice a week, has had no attack since he has been in the hospital. Mr. Savory has likewise prepared an extract of the root, and further trials are of course necessary to judge of the efficacy of the medicine. Musk being, however, very expensive, it would be a great boon to the public were this root found as efficacious. Nothing is yet known of the botanical origin of the plant; efforts are, however, being made to ascertain its natural history, and we shall have much pleasure in communicating to our readers the details which may transpire, both in the latter respect, and with regard to the trials which are being made as to the therapeutic virtues of the root.

* *Lancet*, January 12, 1850.

LEECHES DRUNK WILL BITE TILL SOBER.

A Correspondent of the *Lancet* writes thus:—"As some of your readers have, no doubt, been much troubled at times, as well

as myself, how to make leeches bite, I think the following plan for so doing may not be generally known; therefore, I send it for your insertion. Put the leeches that you are going to use into some warm porter, and directly they kick about in it take them out, hold them in a cloth, and they will bite instantly, without fail, even if they have before been tried for some time without any success."

ARSENIOUS ACID AND ALBUMEN.

BY DR. SHERIDAN MUSPRATT, F.R.S.E., PROFESSOR OF THE LIVERPOOL COLLEGE OF CHEMISTRY.

When an aqueous solution of albumen is mixed with an aqueous solution of arsenious acid, and the mixture is evaporated to dryness on a water bath, then washed several times with distilled water till the filtrate contains no arsenious acid, a compound remains on the filter composed of albumen and arsenious acid, which is not poisonous. One gramme and a half of the dry compound was given to a rabbit and no apparent effects were produced. I thought that every chemist at all acquainted with the progress of the science was aware that the fact was established years ago of arsenious acid and chloride of mercury, &c., forming indefinite chemical compounds with albumen, fibrine, &c. Many people think analysis and the preparation of compounds extremely easy. I can state, from my long experience of the science and its methods of investigations, that accurate manipulations are extremely rare; moreover, there are very few *professors* of chemistry, even, on whose results I would place the slightest reliance.

I append the following opinions with regard to albumen and its combinations:—

Professor Graham—"A solution of albumen in water is precipitated by acetate of lead and many other metallic solutions. Insoluble compounds are formed, one of which is of considerable interest, that of chloride of mercury; as albumen is had recourse to as an antidote to corrosive sublimate, the white of an egg precipitating about four grains of that salt."

Sir Robert Kane—"The precipitates yielded by solutions of albumen with metallic salts, are mixtures of two distinct substances—one a compound of albumen with the acids, the other a compound of albumen with the metallic oxide; the former is generally somewhat soluble, the latter insoluble, and hence results the application of albumen as an antidote to mineral poisons—such as corrosive sublimate and blue stone."

Baron Liebig—"Corrosive sublimate and other salts of mercury combine chiefly with albumen and albuminous tissues. Arsenious acid enters into a very firm combination with membranes and gelatinous tissues."

Dr. Alfred Taylor has the following on mercury, which is a very great proof of the fixity of the mercury compound. He says—"If water should fail in extracting the poison, the substance may be brought to dryness and heated with nitro-muriatic acid until the original matter is decomposed and the surplus acid expelled."

If water fails in extracting the poison, and if it can only be detected by destroying the organic compound, the mercury must be in chemical combination.

In employing white of egg as an antidote to metallic poisons, it acts no doubt chemically and mechanically, *i.e.*, by combining with a small portion, and enveloping a still greater quantity mechanically, thus protecting it from the mucous membrane of the stomach.

I have received the following from Professor Gregory, of Edinburgh:—"I have not the least doubt that you are quite correct as to the action of arsenious acid on albumen. When in Dublin in 1837 I made some rough experiments on that subject, as well as on the action of corrosive sublimate on albumen, which satisfied me that Liebig was right."

Dr. Anderson, of Leith, favors me with the annexed:—"There is in my opinion no doubt that the metallic poisons are capable of uniting with animal matters, and this, I apprehend, is perfectly well known to all toxicologists, and is the universally-received explanation of their antiseptic properties."

ADULTERATION OF DRUGS AND CHEMICALS.

NO. I. SULPHURET OF ANTIMONY.

"The Chemist" has, from its commencement, been the most efficient medium for unmasking the almost endless varieties of adulteration practised by dealers in chemicals, &c. Much good, doubtless, has been effected by the unmasking of many gross frauds in former volumes, yet it is a grievous thing to think that there should still be so many more to lay before the public.

I will begin on this occasion with the *ant. sul. nig.*:—This *ought* to be a tolerably pure proto-sulphuret of antimony (prepared on a large scale by refining the native ores of that metal), whilst, by experience, I find that in nine times out of ten it is little else than the "*scoriæ*," formed during the manufacture of

metallic antimony for the use of type-founders and other workers in metal. Sometimes the merchant's conscience will not permit him to mix more than about two-thirds of this rubbish with the genuine article; whilst others, again, hesitate not to push it into people's hands alone, and without a particle of sulphuret of antimony in it. Now the only plan that I can conceive those individuals must adopt to ease their consciences is, that the pure article being generally styled "black antimony," and being known by this better than otherwise, therefore, on persons asking for it under that title, they think they can be doing nothing dishonest by giving them the black *dross of* antimony, as it *is* black antimony—"black," sure enough! for there is no lack either of coal-dust, or of ground cinders and ashes—necessary constituents in almost all scoriæ of metals.

I have occasion to use the sulphuret of antimony, and have experienced many mortifications and loss of materials by the employment of this spurious compound, for it is not of the slightest earthly value for the purpose I employ the genuine article for. A commercial article is certainly not expected to be chemically pure, but, when an absolutely different thing is substituted and passed off for another one, it is downright robbery. I find the distinctive term "*scoriæ*" to be rather too well known among the wholesale gentlemen, and they can purchase and supply either that or the genuine article just as their propensities happen to be good or bad.

The substitute is known by its *dull and dark* appearance looking like a mixture of charcoal and plumbago, while the genuine article is a clean *light grey* metallic-looking powder of about the depth of ung. hydrar. full of *sparkling* points of great brilliancy.

I trust that, after this *exposé*, the public will not be subjected much more to this most shameful imposition. For my own part, I would do with those nefarious gentlemen as they do with the butchers in whose possession unwholesome meat is found. I would cause all their stocks of drugs and chemicals to be examined by a competent person, and all bad or adulterated goods immediately destroyed, and the owner subjected to a heavy fine. I know that in no line of business is the villanous system of adulteration carried on more extensively than by the dealer in drugs and chemicals; and I think it unfair—very unfair—to let those rascals pursue their iniquity with impunity, whilst other dealers are watched so closely. Talk of "Medical Reform!"—this would be the best reform ever planned.

T. W. N.

GLYCERINE.

"GLYCERINE," says Mr. Amyot, of Diss, in the "Medical Times," "has been of late undergoing the usual course of under-rating and over-rating, to which every new remedy is invariably exposed, and as I see the '*contra*' side is now getting rather over strong, I beg to declare myself among the '*pro's*' for the good reason that I have used it much, and have found it most serviceable in a number of cases; so much so that I believe I should be puzzled to find an efficient substitute for it. Such cases are the following:—

"1. *Superficial Burns*, whether the vesications are broken or not, used with an equal quantity of water, and applied with a camel's hair brush, it gives great relief, and keeps the part moist for a long time. This is most useful in burns of the face near the eyes, &c., or when dressing on lint, &c., cannot be well used.

"2. In *sore nipples*. In these cases, it was first recommended, I believe, by Mr. Startin, in the *Medical Times*, and I have never found any other application nearly so effectual. About one part to six or eight of water succeeds the best.

"3. In the *excoriations*, in the gums, nates, and behind the ears of infants.

"4. In *Parrigo favosa and scutulata*, and other skin diseases, but especially in the first-named (when the crusts have been removed by bread-poultices). It should be used as a wash, diluted with eight or ten parts of water. I employ the pitch and sulphur ointment at the same time in these cases; but I do not find the latter so rapidly effectual *alone*.

"My actual experience in the use of this remedy goes but little further; but, I have, no doubt it is very useful in chaps, &c., as Mr. McDougal has said, and, indeed, in any of the numerous class of cases where it is an object *to secure moisture of surface and to protect from exposure to air*. At the least, I cannot consent, at the suggestion of another of your correspondents, to mount a crape hat-band, *as yet*, for glycerine.

ARSENIC IN UNFERMENTED BREAD.

WE predicted some time since that accidents would arise from the use of common muriatic acid in making unfermented bread. The following extract is quoted from a letter by Mr. Davis addressed to the provincial journal of Dec. 26th. It comes in the shape of a communication from Dr. Henry, who says—

"My attention was forcibly called to the

question of impurities present in the common muriatic acid by the injurious effects of bread made on the non-fermented principle upon my own family and myself. In all, nausea and severe pains in the stomach followed its use (continued for three weeks before discovery) in some instances vomiting and irregularity of bowels though not actual diarrhœa; and in one case (my footman) the outbreak of the eczema arsenicale.

I lost no time in testing the acid for metallic impurities, but not happening to have any sulphuretted hydrogen, could at first detect nothing. When I procured some I was astonished by its throwing down a dense yellow precipitate which I at first suspected to be tin (from knowing that the manufacturers also made muriate of tin) but soon discovered to be arsenic.

It has been long known to English chemists that much of the sulphuric acid sold is largely contaminated with arsenic. It is the sulphuric acid manufactured from pyrites which generally contains arseniuret of iron. Arsenic, therefore, may be thus transferred to nitric acid, muriatic acid, and numerous salts in the preparation of which sulphuric acid is largely employed. It may even find its way into the diluted sulphuric acid used medicinally. Under a proper system of medical police the sale of this poisoned acid would be strictly prohibited.

GUN COTTON.*

Among some new discoveries at the other side of the Atlantic, is that of a substance analogous to gun cotton, which promises to play an important part in the treatment of nervous diseases. Glycerine is poured on the acids in place of cotton. An oily residuum is the result, which seems to act very powerfully on the brain—producing intense headache.

THE INFLUENCE OF OZONE.†

BY M. SPLENGER.

In the village of Roggendorff, in Mecklenburgh, towards the end of 1846, slight catarrhal affections were prevalent; the air, at that time, contained only slight traces of ozone. At the commencement of the year 1847, these catarrhal affections assumed the most serious forms of bronchial and catarrhal affections, and hooping-cough (*coquehiche*) affected a large portion of the population. At this period was perceived a considerable increase in the proportion of ozone contained in the atmosphere, and influenza was immediately developed. On the 9th of January, the ozonometer showed a still greater increase in the proportion of ozone in the air. On the same day two persons died of the influenza, and the disease gradually progressed to such an extent that on the 21st very few persons had escaped it. There was, therefore, a perfect connection between the presence of the ozone and the propagation of the disease. It is known that ozone is formed in the air by the decomposition of water, by means of disturbances of the electrical equilibrium; hence its powerful sulphurous odor. Its composition and its nature are still uncertain. Sulphurous acid, and probably, also, elluric, selenic, and phosphoric acids destroy it. A very small quantity of vapor of ether, of alcohol, or of olefiant gas is sufficient to prevent its development. Iodide of potassium is the most certain reagent for detecting its presence. A piece of paper steeped in a mixture of starch and iodide of potassium constitutes an ozonometer of excessive delicacy. The smallest quantity of free ozone, which neither the eudiometer nor the galvanometer would indicate, is detected by a change in the color of the paper thus prepared. At the commencement of the epidemic the paper turned rather brown, but, at last, it became entirely brown. Since sulphurous vapors prevent the production of ozone, it follows that the workmen employed in various manufactures in which sulphur is concerned, ought to escape this influenza. This M. Splenger says, he has proved.

A SPECIFIC IN CHORDEE.*

Has been found, according to American journals, in lupulin, which may be worthy of trial in that affection. Dr. Page, of the Philadelphia Hospital, has found it of great value. He gives it in doses of from five to ten grains.

ANALYSIS OF COD LIVER OIL

Analyses of three kinds of cod liver oil have been made in America, which seem to corroborate the opinion that "light brown" is best, containing more iodine, and which we are inclined to look on as not less of

* *Medical Times*, January 12, 1850.
+ Hœule's *Zeitschrift*.

* *Medical Times*, January 12, 1850.
† *Medical Times*, Jan. 12, 1850.

value in this excellent medicine—phosphorus. Dr. Williams's experience, which has been the chief cause of its immense use in America, has been very remarkable. He prescribed it at the time of publishing his results in over 400 cases of tubercles of the lungs; in 100 cases of incipient softening, its effects were decided and lasting, and in 206 out of 234, marked and unequivocal improvement almost immediately followed its exhibition. Nay, among the appalling ravages of the third stage of the disease, in over 60 cases he found it of very great value. Its mode of action is, of course, open to much speculation. In an analysis of the blood in an individual taking the oil, the animal matters were found nearly doubled, the fibrin, usually high in phthysis, was reduced. There seems some reason, then, for supposing that, in addition to this healthy nutritive matter (a sort of magazine to the system), that the oil supplies certain fat molecules, which appear essential to forming the nucleoli of the primary cells of ordinary tissues—fat, according to Ascheron, having the physiological power of coagulating albumen around it.

REJOINDER TO "A FRIEND OF LIEBIG."

GENTLEMEN—Feeling jealous for the honor of Science and her sons, one cannot help lamenting, when philosophers mingle with their learned quarrels so much puerile and foolish personality—the impartial accuracy of scientific research is not likely to be promoted by such wrathful demonstrations; they hinder rather than assist endeavors to attain the truth, and, to impartial men, suggest the query of the wandering poet—

"Tantœne animi cœlestibus iræ?"

The gentleman who condescends to blast me with the lightning of his scorn, adds but another to the many mournful illustrations of this truth, and proves that there is no position so high as to be above temptation, no learning so profound as to reach the depths of human frailty.

Science herself cannot shield mankind from the common curse of mankind, nor preserve them wholly from their greatest enemies—mistakes.

Blinded by his anger, your correspondent has attributed to my letter a construction it will not bear, and chastised my presumption accordingly.

He represents me as claiming for Dr. Brett equality with Liebig as a scientific authority—an idea simply absurd. The privilege we claim for Dr. Brett is, the full enjoyment of that mental liberty which binds upon no man the opinions of any other simply because they are his, including, as it does, the right to examine Liebig's publicly announced opinions as fully and freely as any other man's. The abuse your correspondent heaps so liberally on Dr. Brett, as it in no wise affects our position, needs, at our hands, no reply.

The prosperity of the Liverpool College of Chemistry must be highly gratifying to its Professor, and the business engagements of Messrs. Thompson and Dr. Brett, no doubt satisfactory to themselves, but in what manner these things can affect the solubility of albuminous compounds, or the right of private judgment among philosophers, we cannot imagine. In short, gentlemen, as all these things are quite irrelevant, we presume "A Friend to Liebig" is an enemy to Dr. Brett, and that they are introduced to damage the Doctor's reputation, and gratify the writer's malice.

The only question at issue—the nature of the coagulate produced by the action of $As O^3$ on albumen—my courteous opponent will find fully discussed in a paper by Mr. Edwards, of Liverpool, read at a recent meeting of the Chemical Society; a perusal of this paper might, perhaps, prove to your correspondent that Dr. Brett had good reasons for considering Liebig's theory as "fallacious and unsubstantiated;" reasons most probably deduced from his own experiments, and that wherever Dr. Brett *did* study, he, at all events, acquired the art of careful manipulation, which acquisition has been the means of preventing him from publishing erroneous results in a widely-circulating journal, and thus proclaiming publicly his incompetency to wash a coagulate.

I am, gentlemen, yours faithfully,

ALPHA.

London, January 15, 1850.

MIXTURE OF CAMPHOR AND CHLOROFORM.*

A new mode of administering camphor consists in uniting it with chloroform, in the proportion of three pints of the former to one of the latter. The solution is rapid and complete. The addition of a quantity of water made into an emulsion with yolk of egg did not separate either body. If sufficient of this emulsion, to form 120 grammes, be added, one teaspoonful of this mixture will represent about 25 centigrammes of camphor.

* *Journal de Chimie Medicale.*

ATTEMPT AT POISONING IN PARIS.*

A person lately presented the following prescription at the *pharmacie* of M. Vée: —Decoction of barley, eight ounces; hydrochloric acid, one drachm; arsenious acid, ten grains. The signature of a well-known physician was appended to the prescription. As M. Vée suspected foul play, he took the address of the person, and said the medicine would be sent. The physician, whose name had been made use of, was applied to, but he knew nothing of the recipe. The address of the individual was, of course, false. We beg to remark, that, in this country, people with criminal intentions, are not put to such shifts; the matter is done without any subterfuge; you buy your arsenic, and put it to what use you please, and no one interferes with you.

CREOSOTE TO REMOVE THE TASTE OF COD-LIVER OIL.†

Dr. Barclay says: "In a large number of cases of consumption, in which I have used the oil during the last six months, I have found considerable difficulty in obviating the *sickness* which, in many cases, follows its administration. After trying in vain the essential oils, &c., I at last prescribed one drop of creosote in each dose of half an ounce of this oil; they mingle ultimately, and I have much satisfaction in stating that it has succeeded in every instance (with one exception) in preventing even any nausea being felt by my patients, who liken the taste to that of red herrings."

EMPLOYMENT OF CASEIN AS AN ENVELOPE FOR MEDICINES.‡

BY M. JOSEAU.

In order to disguise the disagreeable odor and flavor of pills, and to increase their durability, M. Joseau recommends coating them with casein instead of with gelatine.

Take fresh casein free from butter, put it for twenty minutes into boiling water, press it strongly, and then dissolve it in a sufficient quantity of solution of ammonia, so as to form a liquid having the consistence of syrup; then mix it with sugar (about one-tenth of the weight of the casein), evaporate the whole to dryness, and rub to powder.

In order to envelop pills with it, a small quantity of the powder is to be dissolved in water, so as to form a thick mucilage, with which the pills are to be moistened. They are then to be covered with the powder. The pills must be coated two or three times, according to the intensity of their odor and flavor. After the last coating of mucilage, they are to be dipped into slightly acidulated water, instead of being covered with powder, and are then to be dried.

USE OF SULPHATE OF IRON IN DYSMENORRHŒA.

American Journal of the Medical Sciences. Dr. N. Ward, of Burlington, Vermont, reports that in several cases of painful menstruation, he has obtained the best results from the use of ½ gr. of sulph. ferri, with a slightly laxative dose of sulph. magnesia, every day during the interval of the monthly periods, or for the last ten days of the interval.

FALSE VALERIANATE OF ZINC.

Our attention has been called to the valerianate of zinc of commerce, which varies very considerably in odor and external appearance. The fact above-mentioned arises from some manufacturers employing in the preparation of this compound valerianic acid, which has been artificially produced by some one of the processes which have, from time to time, been published. So varied is the appearance of the articles sold by the name of the valerianate of zinc of commerce, as to leave but little doubt that many of them are not valerianate of zinc at all.

We have not yet been able to thoroughly investigate the subject, but hope to be able to do so at an early period.

The compounds which we have seen are very numerous, many of them agreeing, in some of their characteristics, with that compound prepared with the acid obtained from the valerian root, whilst others differed very considerably.

We earnestly recommend our readers, in what we consider the present unsatisfactory position of this matter, to purchase only that compound which has been prepared from the valerianic acid obtained from the valerian root.

Valerianate of zinc should be very nearly white, looking somewhat like the smallest scales of a fish, very light—so light, indeed, that it flies about with the slightest agitation of the air—and possessing the characteristic

* *Lancet*, Dec. 8th, 1849.
† *Provincial Journal.*
‡ *Pharm. Journ., Dec.* 1849.

odor of the valerianic acid, slightly soluble in cold water, but much more so in hot water. When the true valerianate of zinc is placed in cold water, it is only with some difficulty that it is rendered moist by it.

A sample of the true valerianate of zinc may be seen at the office of The CHEMIST, as we have placed a sample of it in the hands of our publisher, for the guidance of such of our readers as may be desirous of purchasing this article and are unacquainted with it; and we beg to inform the public that we shall adopt this plan as regards other compounds which are under our notice at the present time.

ON THE DISCOVERY OF TWO ANTIDOTES TO POISONING BY THE ARSENIC OF COMMERCE.

BY THOMAS CATTELL, M.D., M.R.C.S., &c., BRAUNSTON.

DURING the past year while experimentalising on the means of constituting the arsenic of commerce self-detective, my attention was in part directed to the discovery of an antidote or antidotes which could be more conveniently, if not more effectually, applied in cases of poisoning than the only one which has hitherto been discovered—the hydrated peroxide.

I have not had an opportunity of fully completing these experiments; but the vital importance of the subject leads me to direct immediate attention to two agents, which it is anticipated will be found to supply the desideratum sought to be obtained—the one is ferrate of potassa, or the ferric acid compound—the other the dry peroxide of iron.

It is found by experiment:—I. That when one ounce of the ferric acid compound, forty grains of arsenic, and one ounce of water, are intermixed and well agitated, the supernatent fluid gives no evidence of the presence of arsenic by the usual liquid tests. After the space of a few minutes the formation of crystals takes place at the bottom of the fluid, and indicates that the whole or a portion of the arsenic is neutralised.

These crystals possess a slightly acrid taste, are insoluble in cold water, are not deliquescent or subject to change, on exposure to the air for several months.

II. That when one ounce of the ferric acid compounds, and forty grains of arsenic in an alkaline, solution are treated in a similar manner, the supernatent liquid shows no evidence of the presence of arsenic by the same tests.

III. That when half an ounce of the dry peroxide of iron, five grains of arsenic, and one ounce of water are agitated together, the supernatant fluid is without any evidence of the poison.

In the administration of the ferric acid compound for the purposes in question, it is unnecessary to observe that no precise amount can be adhered to on merely theoretical grounds; the quantity of the poison taken, or administered, is always uncertain; and it is better, in this instance, to err on the side of excess.

As to the chemical re-action of this compound on arsenic, I have nothing to observe really bearing upon the subject, further than to state that it is my anxious wish it may prove as valuable practically, as it appears to do theoretically.

The compound should be reduced to pulverisation immediately prior to its administration.

I cannot conclude these brief remarks without expressing my feelings on the subject to which they have reference. It is not antidotes that we require, how valuable soever they may be—it is a legislative enactment prohibiting the sale of so deadly a poison without the adoption of some precautionary measure—*i.e.*, without rendering it self-detective.

It is, therefore, my opinion, that if the question is taken up by the worthy and able editor of the *Lancet*, and warmly agitated by the profession, the Legislature cannot fail to carry out the views which I have expressed relative to this subject.

Braunston, Northamptonshire, 1849.

GUTTA PERCHA.*

THIS substance, which has been turned into everything, from bas reliefs to candlesticks, Dr. Jacob considers nearly invaluable for the construction of catheters. The ordinary gum-elastic instruments are now, according to Dr. Stapleton, fabricated in the most singular way. Without a bit of gum-elastic in their composition, of a woven tissue, in the same manner as ordinary cutting whips, this structure, steeped in drying oil, is dried, polished with pumice, and varnished! Left in the bladder, the layers strip off one after another, and, it requires little stretch of imagination to conceive, may often form the nucleus of dangerous deposits. Gutta percha, on the contrary, is far more cheap; immersed in urine, as Dr. Jacob found, it suffers no change—even after a fortnight—and is every other way adapted to the formation of flexible instruments. Gutta percha catheters are used in the Paris hospitals. The brittle-

* *Medical Times*, Jan. 12, 1850.

ness of the new substance seems its chief fault, but this is remedied by leaving it as homogeneous as possible, excluding coloring matter, and not exposing it to too much heat. Dr. Benson exhibited to the Surgical Society of Dublin a gutta percha stethoscope, which he said was more pleasant to the patient and the physician's ear, and quite as good a conductor of sound as the ordinary wooden one.

THE USE OF HYDROCYANIC ACID IN CASES OF BURNS.

A CORRESPONDENT writes thus to the *Medical Times*:—Place in a mortar two ounces of simple cerate of lard, and rub into it, gradually adding, as much hydrocyanic acid as it will take up, then spread on lint or linen, and apply it to the burnt parts. This treatment will be found to allay all pain and vascular excitement. If the burned surface is very extensive, the patient should not be left while this application is applied, and opium should not be administered in any form with the application. A little child of four years old was treated with this application, whose chest was severely burned, which has caused the child to be in fits before the application was applied; but very soon after its use the fits ceased, and the little patient recovered without a return of them.

METROPOLITAN WATER SUPPLY.

A LECTURE is to be delivered by Mr. J. L. Tabberner, upon this important subject, at Willis's-rooms, King-street, St. James's-square, on Monday, Feb. 4th.

From our personal knowledge of Mr. Tabberner, we feel confident that the subject will be well treated, and we earnestly hope that the meeting will be well attended. The water supply of London is a subject of the most vital importance to every person, rich or poor, who resides in the metropolis. By the present system, dirty water is sold to the inhabitants at a much higher price than would be remunerative for pure water.

TO CORRESPONDENTS.

"EXTRACT, COTYLEDON UMBILICUS."—We have received from Messrs. Randall and Son, of Southampton, a sample of this extract, prepared by steam. It is an excellent preparation.

We are obliged to Dr. Muspratt for a very well-executed lithograph portrait of himself. It is exceedingly correct,

"The Specification of Recent Patents" will be resumed in our next.

"JUVENIS B." asks if we know of any person who lends medical works to read. We do not; but should recommend him to apply to some of the large circulating libraries. The formula of pil quinæ et camphoræ is camphor in powder ℈j, sulphate of quinine ℈ji, aloes and myrrh pill ʒiss., syrup of ginger, q. s. makes 40 pills.

"M. J. C."—Do you mean White's process? On hearing again from you in answer to this question, we will write to you.

"MR. HORSLEY" will hear from us by post.

"TYRO."—You can apply to the patentee; or, if you will send your name, we will do so.

"AMATOR SCIENTIÆ" should have sent his name.

"MR. TOZIER" will be answered next month.

Communications received from "M. D.," a member of the Pharmaceutical Society, A Surgeon, Sigma, M.P.S.G.B., Chemicus, Dublin, Mr. Wilson, M.D., Edinburgh, to whom replies will be sent by post.

A few copies of Nos. 1, 2, 3, and 4, may still be obtained.

"J. B. N."—We have to apologise for omitting to answer you last month. It was quite accidental. Perhaps the article by Professor Brande, in the present number, will apply to your first question. We insert the following directions of a filter, sent by J. B. N.:—Take a large square box, made of oak or deal, make it water-tight by binding the corners and sides with tin, nailed on—at the bottom cut a round hole in which fix a pipe, put into the box, to the depth of five inches, clean washed sand, or clean powdered chalk; on that place a layer of charcoal, broken into small pieces, and over this lay a sheet of white card-board, pierced with holes in order to keep the charcoal and chalk well fixed; a piece of wood of the size of the top of the box, well drilled with holes, will answer the purpose equally well. Fix the above in the yard. For the receiver, a large-sized crock or jar will be the best. What is the intention of sending the prescription to us? For insertion, or for our opinion?

NOTICE.—*All Communications and Books for Review must be addressed* "To the Publisher of THE CHEMIST, 17, Surrey-street, Strand, London." *Communications must be pre-paid, and sent before the 15th of each month. Books for Review before the 10th,*

THE CHEMIST.

[NEW SERIES.]

I. CHEMISTRY.

ON THE FUSION AND VOLATILISATION OF BODIES.*

BY M. DESPRETZ.

(*Continued from page* 198.)

I. I HAVE had the honor of reading successively to the Academy, at the sittings of June 18 and July 16, 1849, a note on the simultaneous employment of this most powerful source of heat, and a note on the volatilisation of carbon by the sole action of the heat furnished by a Bunsen's battery of 496 elements, united in four parallel series of 124 elements. In the first communication, I announced that I had fused and volatised magnesia and other refractory bodies, and that I had fused carbon.

At the sitting of the 19th Nov., I presented some results of the fusion of silicium, boron, titanium, tungsten, palladium, and platinum.

I now detail the principal results of numerous experiments on charcoal taken in different states. I employed, in these investigations, a Bunsen's battery of 600 elements, differently arranged, according to each case. I submitted to investigation the charcoal deposited in the cylinders, in which carburetted hydrogen gas is prepared for lighting, anthracite, and graphite, charcoal prepared by calcining sugar, and charcoal obtained by the decomposition of rectified essence of turpentine, in a strongly-heated porcelain tube. Finally, I made some experiments on the diamond.†

II. I need not enterinto a history of the investigations undertaken to effect the fusion of charcoal. I will content myself with mentioning that, notwithstanding the endeavors of Hare, Silliman,* West, Lardner, Vanuxem,† &c., and despite the persevering efforts of the ingenious author of the "Sirène," I find in all chemical works published during the last thirty years this phrase, and stereotyped, as it were: charcoal is fixed and infusible.

In my communication of the 9th July (1849), I proved that charcoal is volatile, like all bodies which are called refractory. I do not confound this volatilisation with the effect of transport noticed by Silliman in 1823, and observed by all who have repeated Davy's beautiful experiment. We are now treating of the direct volatilisation of charcoal, at the temperature given by a Bunsen's battery of 500 or 600 elements, united in five or six parallel series. This volatilisation is manifested under the form of a black cloud, which arises from the entire surface of the charcoal, and which

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* *Comptes Rendus*, No. 25, 17th Dec., 1849.

† The retort charcoal contained $\frac{1}{80}$ of foreign matters (iron, &c.). The English graphite used in these experiments was brought from England by M. De Cayeux, and did not leave $\frac{1}{100}$ of residue; vitreous anthracite, 1·5 per cent. Charcoal of white sugar, crystalline, $\frac{1}{200}$ (lime, &c). Sugar candy, in fine colorless crystals, which I long ago substituted for white sugar, gave $\frac{1}{1000}$ of ash.

* M. Germain Barruel, who is well known to the Academy, has been kind enough to make these analyses. Dr. Silliman himself discovered that the globules which he obtained, and which were colorless, or blueish, &c., were only glass.

† Schweigger's "Jahrbuch," b. 23, 1825.

deposits, in great part, on the sides of the vessel in which the charcoal which unites the two poles of the battery is placed.

I have verified a hundred times, since July last, the direct volatilisation of charcoal in vacuo or in gases.

This volatilisation frequently alters even the purity of the products. Thus, if it be desired to prove the volatilisation of platinum in the air, or that of iron in vacuo or in nitrogen, we find charcoal mixed with the metal in the porcelain capsule, placed even at one decimetre above the charcoal crucible containing the matter treated by the electric fire.

The volatilisation of carbon, iron, and platinum, being proved, it is natural to think that there are few bodies capable of resisting the fire, under the action of which these three bodies have been volatilised. Indeed, I have not yet found any body infusible and fixed in the fire of the battery which I used in my experiments. I will collect, in a fifth communication, the results which I have obtained and shall obtain on this subject. I am very much mistaken if this will not be useful in chemistry, physics, and geology. As regards this last branch of the natural sciences, we know, from the recent researches of M. Elie de Beaumont, the part which the fusion or volatilisation of bodies which are called refractory, may play in the production of certain geological phenomena.—*Bulletin de la Société Geologique de France.*

As I saw the charcoal rapidly dissipated, both by volatilisation and by combustion, I endeavored to weaken the effect of volatilisation, and to destroy the effect of combustion, by operating in nitrogen or in a non-supporting gas, at a higher pressure than that of the atmosphere.

The apparatus which I exhibit to the Academy, and which I have had constructed by M. Deleuil, has enabled me to filfil this double condition.

This apparatus is of cast iron; a moveable cover gives the means of placing a capsule above and below the matter submitted to the action of the current or of the electrical fire; a vertical stem traverses a leathern box adapted to the cover; this stem is isolated by two plates of glass and by two small leathern rundles, to the extremity of this stem is fixed one of the charcoal points; the other point is held by an analogous horizontal stem, traversing a tubulure in the side of the apparatus. We see in the interior of the apparatus by means of two large tubulures, closed with thick glass plates, with quite parallel faces.

A fifth tubulure is intended to be put successively in communication with a pneumatic machine, and with a compression pipe.

A second tubulure is screwed to the tube of a manometer.

With the apparatus thus arranged, the electric current may be passed through a continuous wire uniting the two poles, or through vacuum or any gas whatever.

I constructed a second cover, to which are adapted two leathern boxes; the stems which enter in these leathern boxes are arranged for isolation, like the foregoing; to each of these stems is attached a charcoal point.

This second cover serves for the experiments in which a vertical piece of charcoal is presented to the electrical fire of two horizontal pieces of charcoal kept at a distance. The three stems being moveable, the pieces of charcoal may be arranged as the experiment requires.

The capacity of the apparatus is about 10 litres.

This apparatus I used in the experiments made under degrees of pressure higher than that of the atmosphere.

When I desire to operate in vacuo or in any gas at the ordinary pressure, I substituted for this apparatus a large bell glass receiver, on the moveable platinum of a pneumatic machine. A circular iron plate and a metallic grating defended the platinum and the receiver against the projection of powerfully heated globules and sparks. Without this double precaution, there would be a great liability to break both the platinum and the receiver.

For the experiments in the air I have arranged a box into which penetrate the two conductors of the battery. This box is open on the side of the battery, and closed on the side of the observer. Two openings, one of which is closed with blue glass, facilitate the movements required by the experiment.

This arrangement diminishes the danger attending these experiments, if we were not secured from the electrical heat and light and from the vapors disengaged. We cannot be too securely defended, especially from the electrical light, when it is raised to a certain degree of intensity. The light from 100 elements might occasion serious injury to the eyes; the danger is much greater when this light is furnished by a battery of 600 elements; even in approaching it only for an instant, there is danger of violent head-ache and pain in the eyes, and, moreover, the face burnt as by a powerful *coup de soleil.* Messrs. Bourbouze and Meunier and myself, and particularly the former, were powerfully affected by this too strong light. Since we have taken these precautions no one has suf-

fered: nevertheless, we never allow the same person to direct the electrical fire throughout a whole series of experiments, unless the experiments follow one another slowly.

III. I now pass to the principal results of the experiments in which I bent, soldered, and fused charcoal.

In many experiments in which I passed the current of the battery of which I have spoken, through an acicular rod of charcoal, vertical or horizontal, I have often seen the charcoal bend under the form of an arch of a circle, sometimes even under the form of an S. I obtained this result with the charcoal of the retort, sugar charcoal, charcoal of essence of turpentine, anthracite and graphite; I favored the flexion by pushing the charcoal in the direction of its length when very strongly heated. I thus bent rods of several millimetres in diameter, and several centimetres in length.

I give the results of several experiments made in nitrogen. A piece of retort charcoal, of 45 millimetres between the two points, and of two millimetres in diameter, connected the two poles. The pressure was 2½ atmospheres; it rose to 3 atmospheres during the experiment, which lasted eight minutes. The charcoal was white, hot, and disengaged; very little flame; it sinks down in bending. Every one present at the experiment thought that it would flow. It detached from the upper point, and took the form of an S. The experiment was immediately stopped; the charcoal was examined; every one agreed in regarding it as fused at one portion of its extremity. Such was the opinion of MM. Dumas, Siloup, and Archereau.*

In another experiment, a shorter rod (only 2 centimetres), and of the same diameter, was used. The battery was arranged in 12 series of 50 elements, whilst in the foregoing, it was in six series of 100 elements. The rod bent and broke; the upper part was enlarged at the time of breaking. It resembled scoriæ of iron. The charcoal broken in the middle was graphite; it was the same with the two extremities.† A rod of sugar charcoal, placed between two charcoal points, in Davy's experiment, bent more or less; a rod of the same matter uniting the two poles, was likewise bent, when the heat is managed by making the current of the battery pass only gradually through the rod. I obtained this result several times; but it very frequently happens that charcoal sugar, to which I had not given a solidity equal to that of retort charcoal, broke under the slightest pressure. I shall detail further on, experiments in which circular rings of charcoal took the oval form, are flattened, and even, in part, folded perpendicularly to their plane.

IV. I endeavored to solder pieces of charcoal, as metals are soldered, hoping thus to furnish a striking proof of the fusion of this substance.

In one experiment, two vertical threads, one of 1 millimetre, the other of 1¼ millimetre in diameter, unite the two poles; the finest is folded on the largest, without soldering. The rupture took place at the lower part; at the point of rupture the two parts separated had doubled in diameter; the two parts of the lower point, which was of sugar charcoal, were adherent in several points, like two soldered bodies.

Another experiment, made with two threads of about 1 millimetre in diameter, and connected by circular rings, were broken nearly in the same manner, after being bent. At the point of rupture, the parts were also more bulky, and they had, as in the corresponding parts of the foregoing experiment, all the properties of graphite.

These experiments, with fine threads, were made at a pressure of two or three atmospheres in nitrogen. Mr. Ruhonkorff was kind enough, at my request, to arrange the charcoal rods with rings. It was a very delicate operation.

As I was not able to solder, by contact alone, charcoal threads placed vertically and surrounded with rings, I called in the aid of compression and heat.

Two ends of retort charcoal, together of the length of 50 millimetres, and of the diameter of about 5 millimetres, were submitted to the action of 600 elements, united in series of 50. I made this arrangement on account of the size of the rod.

The two faces in contact were cut in such a manner as to join perfectly. The charcoals were pushed in the direction of their length; the positive charcoal penetrated into the negative charcoal to the depth of 4 or 5 millimetres. The latter open in two. At the moment when the apparatus was undone, the rupture took place, but not at the point of junction. There rested on the positive charcoal a portion equal in diameter to the

* I often call in the testimony of persons present at the experiments. In such a subject it is easy to be deceived. In order not to fall into this cause of error, I have always requested the opinion of persons assisting at the experiment.

† These experiments are always complex. I detail experiments in which charcoal was bent; but as results can be obtained only at a very high temperature; a portion of the charcoal is almost always at the same time fused and converted into graphite.

charcoal itself, at least 2 millimetres in thickness. This cannot be the effect of transport; the two charcoals were strongly pressed in the course of the experiment. The transport is made from the positive to the negative charcoal; it was the positive charcoal that retained the welded portion. It was not a pappy and rounded mass, but a cut similar to a fracture which is produced in two bars of iron, welded end to end, under the sole action of a high pressure and heat, without the aid of a hammer. In communicating pressure the charcoals were felt to be penetrated like two soft bodies.

In the arts the mechanic facilitates the soldering of the sparingly fusible metals, as steel and iron, by the action of the hammer. I wished to press and strike the charcoals at this point of junction with small pieces of charcoal, arranged in another manner. I did not go farther than in the foregoing experiment. It will be perceived that it is not possible here to take the point of support which the mechanic has in his anvil.

In substituting sugar charcoal for retort charcoal, the charcoals penetrate into each other; this was perceived on pressing. In several experiments there was also a species of welding.

In some experiments the charcoals seemed to be more easily penetrated when a current of oxygen was directed on the parts in contact.

When we place, in these experiments, capsules (either empty or full of water) under the charcoals, we see on the sides of the capsule or on the surface of the water, light, extended plates, similar to those observed in soldering with tin objects placed at a certain height; they are only lighter and finer, and consist merely of ununited points. When it is desired to collect them, nothing but dust is found; this dust leaves on paper traces of graphite, which does not scratch glass.

V. Experiments which seem to me to put the fusion of carbon beyond doubt.

A thread of charcoal of 15 millimetres in diameter, and 25 centimetres in length, between the points to unite the poles of the battery of 600 elements, arranged in six parallel series.

The pressure of nitrogen was 2½ atmospheres.

The charcoal was of a dazzling white heat; the matter seemed to collect at the lower part: it broke at this point. The two parts separated had doubled in diameter.

This increase of size, by heat alone, can scarcely have taken place without a commencement of fusion.

In another experiment, with a thread of 1 millimetre in diameter and 12 centimetres in length, between the two points, heat was gradually applied by means of 100 and 200 elements in series of 100 each. The wire broke at the lower part before it had received the action of 600 elements; at the two points separated by the fracture, it had tripled in diameter; the two fragments were black; they left traces on paper, like graphite; they acquired a polish by friction.

A rod of sugar charcoal of 3 millimetres in diametre and 1 centimetre between the two points: the charcoal was pressed and bent, and it broke at the lower part; it became larger at the point pressed upon: a fragment was detached which presented a pappy surface, like a fused body. This fragment and the parts separated by breaking, had all the properties of graphite. The points remained intact.

In a fourth experiment, with a thread of 41 millimetres between the two points and 1½ millim. in diameter, heat was applied at first with 100, then 200 elements; the thread bent before 300 elements had been employed, and broke when heated with 500 elements in series of 100. The two parts were also enlarged at the point at which they were broken.

These two experiments were made in nitrogen.

In a fifth experiment, in the air, with a thread of the same length and 2½ millimetres in diameter, the thread bent with greater difficulty, but it ultimately bent under pressure; it broke near the positive pole. The positive rod was slightly swelled, and presented the form of a sphere.

In a sixth experiment, the positive point was swelled and changed into graphite.

A seventh experiment, in nitrogen, with a thread of 12 millimetres between the two points and 1 millimetre in diameter, placed vertically, also presented, at the rupture which took place at the lower part, a triple diameter and a complete conversion into graphite.

(To be concluded in our next.)

ON THE WATERS OF THE DEAD SEA.

BY THORNTON J. HERAPATH, ESQ., AND WILLIAM HERAPATH, ESQ.

THE Dead Sea, or as it is called by the Arabs, Bahr Lout (Lot's Sea) though somewhat insignificant in size, has, nevertheless, in consequence of the extraordinary physical character of its waters, and the awe and mystery which ancient tradition has thrown around its history, attracted the attention of mankind from time immemorial. Under the several appellations of the "Salt Sea"

(Numb. xxxiv., 3; Deut. iii., 17; Josh. xv., 5), the "Sea of the Plains" (Deut. iv., 49), and the "East Sea" (Ezek. xlvii., 18; Joel ii., 20), frequent mention of it is to be met with in the Holy Scriptures, and, in fact, it is now supposed to occupy the site of the cities of Sodom and Gomorrah, the destruction of which, by the wrath of the Almighty, is so graphically described in the 18th chapter of Genesis. In the works of the Greek and Roman authors, again, it is often referred to by the name of "Lacus Asphaltites," or the "Bituminous Lake," and many remarks upon the exceeding saltness of its waters, and the sterility and desolate aspect of its shores are to be found in the pages of Tacitus and Pliny.*

The lake itself, as is well known to every person acquainted with geography, is situated in the south of Palestine, at no great distance from Jerusalem, and is principally supplied by that venerated stream, the Jordan. Its breadth, it would appear from a survey, undertaken by Messrs. Moore and Beke in 1837, is about nine miles, and its length, according to the same authorities, is thirty-nine or forty miles. The latter, however, is found to vary considerably at different times of the year, according to the extent of the influx derived from the Jordan, and other tributary rivers.† The bottom these gentlemen found to be rocky and of very unequal depth, ranging 120, 180, 240, and even 480 feet, all within the distance of a few yards. With regard to its geological situation, the lake lies in a deep basin, of an irregular oblong figure, and is surrounded by steep cliffs of naked limestone, which, on the western side, run up to the height of 1,500, and on the eastern to 2,500 feet above the level of the water.

On the surface of the sea there is often found floating an immense quantity of asphaltum, which is generally carried by the influence of the wind to the western and southern shores, where it is carefully collected by the Arabs, who use it as pitch, and sell it for medicinal purposes. It was this substance which seems to have been employed in ancient times, by the Egyptians, to a very great extent for embalming bodies. There are also several mines of sulphur and rock salt in the sides of the mountains, on the western coast, which not only afford supplies of those useful articles to the Arabs, but even to the inhabitants of the Holy City. Indeed, many travellers have stated that the remarkable saltness of the waters is principally occasioned by the existence of similar saline formations at the bottom of the sea. So deeply, in fact, is the surrounding soil impregnated with this ingredient that few or no vegetables will grow there, and it is from this circumstance, combined with the absence of all animal life, either in the waters or on the shore, that recent travellers have conferred upon the lake the name "Mare Mortuum," or Dead Sea. The water, like that of the sea, is stated to be of a deep blue color, shaded with green; but it is considerably more salt, and intolerably nauseous and bitter to the taste. Rae Wilson, who wrote some years ago, describes it to be not unlike the Harrowgate waters in taste and smell, but more disagreeable; although it approached more closely in character to bilge-water. Its specific gravity is so great that it is almost impossible for a man to sink in it; persons who are entirely unacquainted with swimming can lie, sit, or swim in it with the greatest ease. Josephus relates that the Emperor Vespasian, for the sake of an experiment, caused certain men to be thrown into this sea with their hands and feet bound with cords, and they floated on the surface. Bathers in this lake, however, experience a curious sensation of the eyes, which has been described by Mr. Legh as temporary blindness; and, upon getting out of the water, evaporation proceeds only very slowly, leaving a thick oily incrustation of salt adherent to the skin, which remains for many days, as it is impossible to remove it completely even by repeated ablution.

Notwithstanding, however, that the most obvious peculiarities of the water of the Dead Sea have been known and recognised for many ages, it has only been in comparatively modern times that scientific men have attempted its chemical examination. Within the present century, Lavoisier, Marcet, Klaproth, Gay Lussac, Gmelin, and Apjohn have each analysed it.

The celebrated Lavoisier experimented upon it, in conjunction with the no less renowned countrymen MM. Macquer and Sage,* in the year 1778 (*vide* table). At that early period, however, analytical chemistry had not attained to such a degree of accuracy as that of which it is now capable, and, consequently, there is little or no doubt but that they must have over-

* Tacitus, lib. v. Hist., cap. vi.; Strabonis Geogr. Plinii, lib. v., cap. xv. and xvi.; see also vol. ii. p. 1107.

† It is more than probable that its dimensions have become contracted in modern times, as, if we may believe Josephus at the period when he wrote, it was 72 miles long by 18 broad.

* "Mémoires de l'Académie des Sciences," p. 69.

looked many of the most important constituents. The same remarks apply to all of the three analyses which follow next in the series, namely—that of Dr. Marcet, in 1807; of Professor Klaproth, and of M. Gay Lussac, in 1818. The former of these analysts was, moreover, inconvenienced by the smallness of the quantity which he operated upon, which did not amount to more than an ounce and a half. The great differences which are to be observed in Professor Klaproth's numbers (*vide* Table), as compared with those obtained by the other two experimenters, according to Dr. Marcet, are occasioned by that chemist having employed too low a temperature for the purpose of desiccation. The last two analyses of these waters that have been published are those by Professor Gmelin, of Tübingen, and by Dr. Apjohn, of Dublin. The former appeared in the year 1826, and the latter in 1837. They are given in the synoptical table at the end.* On comparing the results of these six analyses, it will be seen that in no two instances do they agree either in the proportion or composition of the contained salts. The two latter by Gmelin and Apjohn, are evidently most to be depended upon, for the reasons already stated; but even between these, many very great differences occur. The lower specific gravity of Apjohn's specimen which was occasioned by its having been collected at the close of the rainy season, and at about half a mile from the mouth of the Jordan, may, it is true, partly account for these; but it certainly will not explain the absence of the chlorides of aluminum and ammonium, both of which were found by Gmelin, the former, particularly, in rather considerable quantity. For these reasons it was, therefore, obvious that another analysis of the waters, performed with all the care and precautions that are now usually employed in this species of investigation, was absolutely necessary in order that we might be enabled to determine which of the above analyses was the most trustworthy, or to point out the cause or causes which led to the discrepancies observed. Consequently, when Mr. C. J. Monk (son of the Venerable Bishop of Gloucester and Bristol), who has recently returned from a long journey in Syria and the Holy Land, kindly offered to place at our disposal, for this purpose, a bottle of the water; we most willingly acceded to his proposal, with what result the following pages will testify. The specimen so presented to us was collected by Mr. Monk, himself, on the 10th of March last, near the north-western extremity of the lake, about half-a-mile from the spot where the Jordan enters, but quite apart from all direct influence arising from the stream of fresh water which flows into it.

* An analysis, by Dr. R. Marchand, appeared this year in the "Journal für prakt Chem.," B. xlvii. 353. "Journal of Chemical Society." See THE CHEMIST. —ED.

I. PRELIMINARY EXAMINATION.

The water was perfectly clear and colorless, and did not deposit any crystals on standing in closed vessels, even when cooled considerably below its ordinary temperature. Its taste, as we have before observed, was intensely bitter and nauseous, and when swallowed, even in small quantity, it produced a sensation bordering on sickness. It possessed no unpleasant odor. Its specific gravity, at 66° F., was 1·17205. The boiling point, as determined in a glass vessel, with the barometer at 29·74 inches, and the thermometer at 47·75°, was 221·75° F.* It did not exert any definite reaction upon either blue or reddened litmus-paper, proving the absence of all uncombined acid and carbonated alkali; neither did it in the slightest degree affect acetate of lead paper, as from Rae Wilson's statement we should have expected. Only the slightest perceptible opalescence was produced in it upon boiling, or on the addition of an ammoniacal solution of chloride of calcium, when, in the latter case, care was taken to add previously a sufficient quantity of muriate of ammonia to prevent the precipitation of the magnesia. Consequently, only the faintest traces of carbonic acid, or carbonate of lime, were present.

The chloride of gold test of Dupasquier, gave unmistakeable proofs of the existence of an abnormal proportion of organic matter. Other reagents showed that it likewise contained magnesia or magnesium, lime, alumina, the oxides of iron and manganese, soda, potassa, and ammonia; also chlorine, bromine, and sulphuric acid, with traces of silica, bitumen, and iodine. The latter occurred only in exceedingly minute proportion.

* Dr. Apjohn found that of his specimen to be 221° F.

II. QUANTITATIVE ANALYSIS.

A. Determination of the entire amount of saline ingredients.—Great care was requisite in this part of the investigation, in order to avoid loss from the evolution of hydrochloride acid, by the decomposition of the earthy and metallic chlorides at the high temperature to which it was necessary to expose the saline residue previously to weigh-

ing. This source of error was obviated by mixing a known weight of perfectly pure and anhydrous carbonate of soda with the water, prior to evaporation.

	Weight of water taken.	NaO, CO^2 employed.	Saline residue obtained.	True per centage of salts.
I.	1281·9296 grs.	229·53	537·727	24·03998
II.	1709·2395 ,,	306·04	717·256	24·05668
		Mean		24·04833*

B. Estimation of the Organic Matters.—The saline residue from the first experiment, which had been dried at a temperature of 350° F., was repeatedly extracted with boiling water, and the solution evaporated to dryness. The dried matters which remained behind were then finely powdered, again dried for many hours at 350° F., and afterwards heated to redness. The loss amounted to 0·792=0·06173 per cent. of organic matters in the water.

The residue from the second experiment (A. II.) was employed in testing for the organic acids; not the slightest trace, however, of crenic or apocrenic acid could be detected.

C, Examination for Nitric Acid.—In this attempt we made use of the test which has been lately described by M. Lassaigne.† A known quantity of the water was evaporated to dryness. The salts thus obtained were then reduced to a fine powder, and treated several times in succession with boiling alcohol, sp. gr. 0·8010, until everything soluble in that menstruum was extracted. The alcoholic solution having been then introduced into a retort, and the greater part of the alcohol removed by distillation, the remainder was evaporated to the consistence of a syrup, and treated with a large excess of recently-precipitated tribasic-phosphate of silver. A moderately large quantity of water was then added, and the chloride, bromide, and excess of phosphate of silver separated by filtration. Upon testing the filtered solution with an alkaline chloride, only a very slight degree of opacity was produced, and even this, in all probability, was caused by the presence of a small quantity of the phosphate of silver, which is known to be not perfectly insoluble in water.

It may be observed that, in a comparative experiment, undertaken in order to ascertain the value of this test, we could readily detect and estimate quantitatively the nitric acid, when 0·01 gr. of nitrate of potassa was added to 970 grs. of a mixture of chloride of sodium and sulphate of soda.

The same negative results, as to the presence of nitric acid in the water, were obtained by our own process, described in the last number of the Quarterly Journal of the Chemical Society (No. vii., p. 203).

D. Determination of the Sulphuric Acid, Chlorine, and Bromine.—*a.* 1709·2395 grs. of the water were precipitated by nitrate of baryta; we obtained of sulphate of baryta 2·013 grs.=0·68235 gr. of sulphuric acid=0·039921 per cent.

b. The filtered solution was acidified with nitric acid, and an excess of nitrate of silver added; the mixed precipitate of chloride and bromide of silver produced, weighed 1060·784 grains. This matter was then heated to redness in a current of dry chlorine gas, and the loss of weight noted—it amounted to 2·004 grs. It therefore contained—

		Per centage of water.
Chlorine....	262·97838 grs. =	15·44420
Bromine....	3·72041 grs. =	0·21767

We likewise examined the water for iodine, both by the ordinary test of nitrate of palladium, and also by that of starch and sulphuric acid, adopting the precautions mentioned by Dr. Cantù,* but only very faint and doubtful traces could be discovered.

E. Estimation of the alumina and the oxides of iron and manganese.—The alumina was precipitated in the first instance with the iron and manganese as sulphurets, the latter were afterwards peroxidised and separated from each other in the ordinary manner. 1709.2395 grains of the water gave a precipitate of the three oxides, which weighed 0·465 gr. This contained—

	Per centage of water.
$Fe^2\ O^3$	0·029=0·001697
$Mn^2\ O^3$	0·064=0·003745
$Al^2\ O^3$.....	0·379=0·022174

* Even this determination, however, it will be hereafter seen, is somewhat below the truth, on account of the sublimation of a small quantity of sesquicarbonate of ammonia, produced by the action of the carbonate of soda on the chloride of ammonium contained in the water.

† *Comptes Rendus*, Aug. 13th, 1849; also see *Chemical Gazette*, vol. vii., p. 363.

* *Raccolta Fisico-Chemica Italiana*, No. XXVIII, 1848. See also *Chemical Gazette*, vol. vi.

F. Estimation of the lime and magnesia.

	Carbonate of lime.	Lime.	Per centage in water.
Water taken 1709·2395	38·320 grs.	21·45903	1·255474
	Pyrophosphate.	Magnesia.	
	154·820 grs.	56·64233	3·313890

G. Estimation of the potash and soda.

Water taken.	Mixed alkaline chlorides.	Potassa chloride of platinum.	Chloride potassium. 20·8075 grs. Chloride sodium 206·9845 grs.
1709·2395	227·792 grs.	67·627	

This quantity of water, therefore, contained—

Potash.... 13·141542 = 0·768853 per cent.
Soda .... 110·391596 = 6·458519 ,,

H. Estimation of the ammonia.—2563·8590 grs. of the water distilled with an excess of caustic potash yielded ammonio-chloride of platinum 0·641 gr. = 0·04591 gr. of ammonia = 0·001791 per cent. in the water.

Now, upon collecting together the above numbers, it will be seen that 100 parts of the water of the Dead Sea yielded, of—

Organic matter (*B*)	0·061730
Sulphuric acid (*D. a.*)	0·039921
Chlorine (*D. b.*)	15·444200
Bromine	0·217670
Peroxide of iron (*E*)	0·001697
Sesquioxide of manganese	0·003745
Alumina	0·022174
Lime (*F*).....	1·255472
Magnesia	3·313890
Potash (*G*)	0·768853
Soda	6·458519
Ammonia (*H*)	0·001791

Consequently, its true composition will be:

	per cent.
Chloride of calcium	2·455055
Chloride of magnesium ..	7·822007
Bromide of magnesium ..	0·251173
Iodide of magnesium	doubtful traces
Chloride of sodium	12·109724
Chloride of potassium	1·217350
Chloride of ammonium ..	0·005999
Chloride of aluminum	0·055944
Chloride of manganese....	0·005998
Chloride of iron	0·002718
Organic matter (nitrogenous)	0·061730
Nitric acid	very doubtful traces
Carbonate of lime	faint trace*
Carried forward	23·987698
Brought forward	23·937698
Sulphate of lime	0·067866
Silica	traces
Bituminous matter	ditto
	24·055564

Total amount of salt, as determined by actual experiment, 24·048330.*

We shall refrain from entering upon any comparison of our analysis with those previously published, but shall content ourselves with calling attention to the subjoined synoptical table, a glance at which will enable us to arrive at a much more correct idea as to the correspondence of the several results than any amount of words would do.

* After the above analysis was concluded, a further proof of the existence of carbonate of lime in the water was obtained in the following manner:—Upon casually examining the sides of the empty bottle, by transmitted light, a very small quantity of a grey floculent substance was seen adhering to the inner surfaces; and this, being separated by means of a clean caoutchouc washer and a few drops of distilled water, was found to weigh 0·029 gr. (per quart). When examined chemically, it effervesced upon the addition of a diluted acid; and the solution was precipitated by oxalate of ammonia, etc., in the same manner as lime. No effect was produced, either by ammonia, or the triple phosphate of soda and ammonia; it, therefore, did not contain alumina oxide of iron, or magnesia.

* Close as is the approximation between these two determinations, yet, if we take into consideration the small loss which must naturally have taken place in the second instance, from the evolution of the ammoniacal salts, it will be seen to be really still more so. Thus, upon reference to p. 340, we shall find, as the mean of experiments, that 1495·5845 grs. of the water, plus 267·785 grs. of NaO, CO^2, gave 627,4915 grs. of saline residue. Now subsequent experiment (p. 342) proved that this quantity of water must have contained of NH^3, 0·02678 gr., which is equivalent to 0·092963 gr. of 2 NH^3, 3 CO^2 + 2HO. Consequently, 627·584463 (627·491500 + 0·092963)—267·785 (the weight of NaO, CO^2 employed) = 359·799463 grs. represent the true weight of the salt contained in that quantity of the water, which is equal to 24·05745 per cent.

TABLE

GIVING THE COMPOSITION PER GALLON OF THE WATERS OF THE DEAD SEA, AS SHOWN BY THE ANALYSES OF DIFFERENT CHEMISTS.

	MM. Lavoisier, Macquier, and Sage.	Dr. Marcet.	Prof. Klaproth.	M. Gay Lussac.	Prof. Gmelin.	Dr. Apjohn.	Messrs. Herapath.
Specific gravity	1·2403	1·2110	1·2450	1·2283	1·2120	1·1530	1·17205
Boiling point	undermined	undermined	undermined	undermined	undermined	221°	221° 75′
Chloride of calcium .... }	33·122·2115	3·221·2600	9·237·900	3·439·2400	2·726·8424	1·967·7098	2·014·2129
,, magnesium .. }		8·561·7700	21·090·300	13·163·6911	9·988·5526	5·948·3270	6·417·6780
Bromide of magnesium	.. ..	.. ..	.. ..	.. ..	372·7022	162·2272	206·0708
Iodide of magnesium	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	very minute traces
Chloride of potassium	.. ..	.. ..	.. ..	.. ..	1·420·0519	687·6492	998·7570
,, sodium	5·426·3125	9·050·0452	6·170·220	5·975·6795	6·004·7206	6·326·8569	9·935·2036
,, ammonium	.. ..	.. ..	.. ..	.. ..	6·1084	.. ..	4·9226
,, aluminum	.. ..	.. ..	.. ..	.. ..	76·0164	.. ..	45·8975
,, iron	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	2·2304
,, manganese	.. ..	.. ..	.. ..	.. ..	179·6063	4·0355	4·9216
Organic matters.....	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	50·6510
Nitric acid	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	doubtful traces
Carbonate of lime	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	traces
Sulphate of lime.....	.. ..	45·77588	.. ..	.. ..	44·7107	60·5325	55·6800
Silica and bitumen.....	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	traces
Fixed salts	38·548·5240	20·878·8510	36·498·420	22·578·6106	20·819·3118	15·157·3380	19·736·5254
Water.....	48·272·4760	63·891·1490	50·651·580	63·402·3894	64·020·6882	65·552·6620	62·306·9690
	86·821·0000	84·770·0000	87·150·000	85·981·0000	84·840·0000	80·710·0000	82.043·4944

EXPERIMENTS ON THE EXTRACTION OF GOLD AND SILVER FROM THEIR ORES BY THE WET WAY.

BY JOHN PERCY, M.D., F.R.S.

ATTENTION has recently been directed to the extraction of silver, by the wet way, from many of its ores, of which large quantities are now imported into this country, especially from South America. Several processes have been proposed; and one, the subject of a patent, is now extensively practised. It consists in calcining the ore with chloride of sodium, precisely as in the amalgamation process of Freiberg, and then dissolving out the chloride of silver formed during the calcination by a hot saturated solution of chloride of sodium. From this solution the silver is precipitated by metallic copper, and then cupelled. I have examined many South American silver ores, and have found them very variable as to the proportion of silver, and the presence of gold and other metals. In one ore I found as much as 30½ per cent. of fine silver. Several smelting establishments have, I know, attempted to work some of these ores in the dry way, but the results have not been favorable. Hence the importance of directing attention to the economic extraction of the silver by the wet way will appear. The ore which I subjected to experiment was an auriferous silver ore, containing a large proportion of blende, with galena, iron pyrites and copper pyrites in small quantity; the non-metallic part consisted chiefly of silica. The silver was present in the state of sulphuret. By roasting, the ore swelled up much, and sulphurous acid was copiously disengaged. I received it in the state of a coarse brownish gray powder. I made numerous experiments on it, to ascertain the best mode of extracting the precious metals in the dry way, and then proceeded with experiments on the extraction of those metals by the wet way, the results of which I now communicate.

The mean of two assays of the roasted ore by the dry way gave, of fine silver containing gold—

7·977 grs. in 1,000.
55·839 in the pound avoirdupois.
260¾ oz. in the ton.

The silver contained 3·78 per cent. of gold. Therefore, the total quantity of fine silver in 1,000 grs. of roasted ore is 7·676, and of fine gold 0·301, or, 250⅝ oz. of fine silver in the ton, and 9 oz. 16 dwts. fine gold.

1. Ammonia extracted some silver from the roasted ore, notwithstanding the roasting towards the last was effected at a bright red heat.

2. A solution of hyposulphite of soda also extracted from it a very sensible quantity of silver.

3. I digested 1,000 grs. of roasted ore for a few hours with a dilute solution of hyposulphite of soda, containing 150 grs. of the crystallised salt. The digestion was made at a temperature just warm to the hand. I filtered, washed well, added to the filtrate an excess of dilute sulphuric acid, and then boiled. Almost immediately on the addition of the sulphuric acid, sulphurous acid was evolved, and sulphur was deposited; but, until the solution became hot, it did not assume a dark color. I boiled for some time, stirring constantly until the supernatant liquor became bright, and the dark precipitate subsided. I filtered, washed well, and dried. I enclosed this precipitate in a sheet of assay lead,* and cupelled. I obtained a bead of fine silver weighing 4·800. An accident occurred in this experiment, which may have caused a slight loss. I treated the bead with nitric acid, and obtained a sensible residue of gold. I parted, with the usual precautions, and melted the residue of gold before the blow-pipe. The bead of fine gold weighed 0·009. The silver, therefore, contained 0·187 per cent. of gold. This result appeared to me to be interesting, as showing that hyposulphite of soda dissolved out a sensible amount of gold from the ore roasted *per se*. Is it probable that, in the presence of a large excess of other metallic oxides, the gold itself may, at least in a certain proportion, have existed in combination with oxygen?†

I treated the residual ore a second time with a dilute solution of hyposulphite of soda, and proceeded in the manner just described. I obtained another bead of fine silver, weighing 0·050. Some loss was also again accidentally occasioned in this second determination.

4. Gold leaf was digested in a solution of hyposulphite of soda; but it did not appear to be in any degree acted upon, neither did silver leaf appear to be appreciably dissolved by the same menstruum, although the surface, after some time, became tarnished, the solution being freely exposed to the atmosphere. A piece of copper wire, which had been previously dipped in nitric acid and washed, was immersed in the solution of hyposulphite containing the silver leaf; but there was not the slightest appear-

* Lead free from silver.

† See a curious letter by Brandt, "Recueil des Mémoires les plus intéressants de Chymie, &c., dans les Actes de l'Academie d'Upsal, &c." Paris, 1764. Vol. ii, p. 357.

ance of the deposition of silver. However, the surface of the copper acquired a dark color, and by subsequent exposure to the atmosphere, became beautifully iridescent.

5. Into a large stoppered bottle I put 1,000 grs. of the roasted, finely pounded and sifted ore. I then nearly filled the bottle with distilled water, and passed a stream of chlorine through for an hour, having previously added 50 grs. of chloride of potassium, with a view to form a stable double salt of gold. After shaking the bottle at intervals during the passage of the gas, there was a manifest absorption of the gas, as proved by the rushing in of the air on withdrawing the stopper. The agitation was repeated several times, and with the same effect. I left the whole for about four days, shaking at intervals. When the powder had subsided after shaking, I uniformly observed the disengagement of numerous small bubbles of gas from the ore. On plunging a spill, burning only with a spark, into the neck of the bottle, combustion was evidently increased, the spark burning distinctly brighter. A strong odor of some oxygen compound of chlorine continued to be evolved. I filtered, and obtained a clear and colorless solution, which I reduced considerably by evaporation. During the evaporation, a white scum formed on the surface, and white matter (Pb. Cl.) was deposited, which, towards the last, occasioned succussions. To the solution thus reduced, when cold, 100 grs. of hyposulphite of soda were added; but the deposited matter did not appear sensibly to dissolve. I treated the residual ore with a solution of 200 grs. of hyposulphite of soda; I filtered and washed. I mixed the filtrate with the solution previously mentioned, and carefully washed in the precipitate. I added hydrochloric acid, and digested as usual, stirring continually. Sulphurous acid did not appear to be copiously evolved. The precipitate thus obtained was reddish brown, and not black. It was washed on a filter, dried, enclosed in 130 grs. of assay lead, and cupelled. The bead, not being clean, was recupelled. I added 100 grs. of hyposulphite to the filtered solution and boiled, when a dark olive brown precipitate was thrown down, which was dried, detached from the filter (the same as used in the first filtration) as completely as possible, and heated in a porcelain capsule to expel the free sulphur. A small quantity of black matter remained, which was enclosed in about 80 grs. of assay lead, and cupelled. When the lead was melted, and I put the filter on it and incinerated, and I also added the bead of silver previously obtained, and enclosed in a small piece of assay lead, I obtained a good bead of fine silver. However, the cupellation was not perfectly satisfactory, as I observed some very minute particles of silver surrounded by black scoria on the sides of the cupel. The bead weighed 5·385 grs. By parting with nitric acid, it yielded of gold 0·100, or 1·857 per cent.

6. One thousand grs. of the roasted ore were treated with chlorine precisely in the manner described in experiment 5, and left during four months. Bubbles of gas continued to be evolved sensibly for a long time; and even at the end of the four months, on stirring the ore, still continued to be disengaged from its surface. The clear supernatant solution was decanted, and the residue treated with a cold solution of 200 grs. of hyposulphite of soda; it was left for two or three days, filtered, and washed with cold water. I then digested the filtrate on the sand-bath with excess of sulphuric acid until the odor of sulphurous acid ceased to be detected. I washed the precipitate with boiling water, when, after long washing, it still continued to become turbid by the addition of Ba Cl (from Pb Cl). The dry precipitate was seen to be mixed with shining, colorless, acicular crystals. I roasted till no odor of sulphurous acid was evolved, and then cupelled the residue with 200 grs. of lead. There was evidently a considerable quantity of matter present which would not pass into the cupel. I recupelled the bead with a small additional quantity of lead.

I obtained a bead of fine silver, weighing 5·80 grs. On the addition of carbonate of potash to the decanted supernatant liquor, a copious white precipitate was thrown down.

7. I digested 1,000 grs. of the finely powdered roasted ore with a solution of hyposulphite of soda, containing 200 grs. of the salt, at a temperature just warm to the hand, and then filtered. I boiled the filtrate, which became brown. I added to the boiling solution excess of dilute sulphuric acid, and continued to digest for some time at about 212° F., stirring continually. I filtered and dried. I detached the precipitate from the filter, and expelled the excess of sulphur by a gentle heat. I enclosed the residuum in about 100 grs. of assay lead, and cupelled. The bead weighed 0·802 grs. This is a very much smaller quantity than that previously obtained (experiment 3) by treating the roasted ore in the state of coarse powder without *subsequent* trituration, as was practised in the present experiment. Is it probable that, by the act of trituration, the associated matter present, which existed in so large a proportion compared with that of silver, may have protected the silver from

the action of the hyposulphite? On adding sulphuretted hydrogen water to the filtrate, after precipitation by sulphuric acid, not the slightest blackness was produced. A precipitate of the pure color of sulphur canary yellow was produced from the reaction of the sulphuretted hydrogen upon the sulphurous acid remaining in the solution. I transferred the ore, after treatment with the salt of soda, into a glass jar, and passed through a stream of chlorine for nearly an hour, stirred well, and left the jar with its contents covered until the following morning. The odor of chlorine still continued to be strongly evolved. I added chloride of sodium, and digested for several hours on the sand-bath, replacing, from time to time, the water removed by evaporation; the surface became covered with small white crystals. Afterwards, I added a solution containing 200 grs. of hyposulphite of soda, and digested at a temperature just warm to the hand, stirring well. I filtered and washed, and again treated the residual ore with a further solution of hyposulphite, containing 50 grs. of the salt. I then filtered and washed. I mixed the two solutions, and digested, as usual, with dilute SO^3 in excess, and filtered. On the addition of HS water to the filtrate, the latter became dark colored. I then added an excess of HS water until the odor of HS persisted, when, after standing, the filtrate did not again become discolored. I washed and dried. The filtrate, which was readily detached from the filter without sensible loss, was gently heated in a porcelain capsule, to expel the free sulphur. It then weighed 24 grs. I enclosed it, together with the ash of the filter, which was incinerated in the same capsule as used for expelling the free sulphur, in 200 grs. of assay lead. The capsule was not stained, and every appreciable trace of matter was removed. By cupellation I obtained a bead weighing 5·005 grs.

I again exposed the residual ore diffused through water to the action of a stream of chlorine, precisely as before, except that, after digestion, during a few hours, I added KO, until an alkaline reaction was obtained, the reaction having been found to be acid. White matter, apparently similar to that previously observed under the same circumstances, again occurred on the surface. I treated with a solution of 200 grs. of hyposulphite of soda. On testing the wash-water with HS water, S was precipitated, and there was not the slightest dark discoloration. I proceeded exactly as before, and cupelled, with about 60 grs. of assay lead. The bead of fine silver weighed 0·675 grs. I again treated the residual ore in a similar manner with Cl for about an hour and a half, and then digested for a considerable time on the sand-bath. On the following day I dissolved out with a solution of 200 grs. of hyposulphite. I treated the filtrate as usual, with dilute SO^3, and tested the wash-water with HS water. I proceeded as before. I employed 100 grs. of assay lead for cupellation. The bead of fine silver weighed 0·154. The total amount of fine silver obtained is 6·636 grs. By parting with NO^5, I obtained of gold 0·197. The silver, therefore, contained of gold 2·968 per cent.

I now boiled the residual ore with a solution containing 100 grs. of K Cy, filtered and washed. By addition of H Cl in excess to the filtrate, a white precipitate was produced; but on continuing the digestion until the odor of hydrocyanic acid could no longer be detected, it became dark coloured, which I believed to be owing to the presence of S in some form. I digested the precipitate with NO^5, and obtained a pale blue solution, which did not become in the slightest degree turbid by the addition of H Cl. On the filter remained only a minute quantity of matter, like sulphur in appearance, somewhat discoloured; and by heat the characterestic odor of sulphur was evolved, and only a minute quantity of matter was left.

8. In another experiment, in which I heated 1,000 grs. of the *finely* pounded ore, triturated after roasting, with a solution of 200 grs. of hyposulphite I obtained a bead of fine silver weighing only 0·81.

9. I digested 1,000 grs. of roasted ore with a solution of common chloride of lime (hypochlorite) on the sand-bath during two or three days. I then washed and digested the residuum, at a *warm* temperature, with a solution of 150 grs. of hyposulphite of soda. I filtered and washed. To the filtrate I added an excess of dilute SO^3, and heated till the supernatant liquor became quite clear. I filtered, washed slightly, and dried. I enclosed the filter, with its contents, in 200 grs. of assay lead, and I subsequently added on the cupel 100 grs. I obtained a bead of fine silver, weighing 5·469, and containing gold, but only to the extent of ·02. I do not, however, place much confidence in this determination of the gold, as the manipulation was hardly conducted with the requisite care. I dried the residual ore, and by trituration reduced it to a very fine state of division, so that it was passed through the finest copper sieve. I suspended it in cold distilled water, and passed through a stream of Cl during about a quarter of an hour, stirring continually. I then digested on the sand-bath, and left till the next day, when I

still perceived a faint odor of Cl. I added 100 grs. of hyposulphite of soda, and digested at a gentle temperature, stirring continually. I decanted and filtered the supernatant liquor. I again digested the residue with an additional quantity of 100 grs. of hyposulphite, filtered and washed. I boiled the filtrate, as usual, with an excess dilute SO^3. The precipitate soon became dark coloured. I digested until the supernatant liquor became clear, filtered, washed and dried. I detached the precipitate from the filter, which was done without appreciable loss; heated it in a capsule, to expel the free sulphur, and digested it with aqua regia. As the white product which was obtained by this means was mixed with minute acicular crystals like chloride of lead, I treated it, after washing, with zinc and dilute hydrochloric acid. I washed and dried the metallic residue, enclosed it in 100 grs. of assay lead, and cupelled. I obtained a bead of fine silver weighing 0·829 gr., making a total of fine silver 6·298. I examined the liquid left after digestion of the first precipitate with aqua regia, for gold. I diluted it considerably, and boiled with oxalic acid. On the following day (the oxalic acid being added at night) I observed a film of reduced gold of a reddish-brown colour; and a few days afterwards I distinctly recognised minute particles having the colour and metallic lustre of gold.

10. I treated 1,000 grs. of the well roasted ore, in its coarsely pounded state, with a cold solution of $Fe^2 Cl^3$ $Fe^2 O^3$ was soon precipitated, being displaced doubtless by the oxide of zinc.* The supernatant liquor became clear and colorless. I added H Cl, which redissolved the $Fe^2 Cl^3$, but it was again precipitated. I added a considerable quantity of H Cl, and obtained a greenish-yellow brown solution. I filtered and washed, and treated the residue with a solution of 150 grs. of hyposulphite of soda. I proceeded as usual with SO^3. I used 200 grs. of assay lead in the cupellation, and obtained a bead of fine silver, weighing 4·909 grs.

11. I confirmed the fact, that when chloride of silver is dissolved in a solution of hyposulphite of soda, and treated with a mineral acid, a copious precipitation of dark colored matter takes place, which is doubtless Ag S. But whether the whole of the silver is precipitated under these circumstances, as sulphuret, I did not ascertain; though from the copious precipitate produced, I think that such is probably the case.

* Oxide of copper will also displace it.

CONCLUDING OBSERVATIONS.

1. The loss of fine silver, in the most satisfactory experiment, was 13½ per cent. Formerly, in the old amalgamation process in Mexico, my respected friend, Mr. John Taylor informs me, the loss frequently amounted to 35 per cent. But, at present, since the introduction of the barrel process, the loss has been reduced to 9, or even 5 per cent. My results, therefore, may be regarded as sufficiently satisfactory to justify attention to them, with reference to their economic application. It is probable that on the large scale, with proper appliances, the silver would be much more completely extracted.

2. I would especially direct attention to chloride of lime and chlorine, as the agents for effecting the conversion of the silver into chloride, and to hyposulphite of lime, which may readily be obtained as a cheap substitute for hyposulphite of soda to dissolve the chloride. The silver, it is obvious, might be precipitated, either as metal or sulphuret.

3. Since many of the South American silver ores contain gold, it is desirable that both the silver and gold should be extracted by one process; and to this end chlorine, or chloride of lime, seems to be indicated by the preceding experiments.

ON THE PREPARATION OF PERCHLORATE OF POTASSA, WITH OBSERVATIONS ON SOME PERCHLORATES.

BY MARTIN DAMBERGER.

CONSIDERING the very important position perchloric acid ought to hold amongst the re-agents employed in analytical chemistry, it is somewhat strange that it should have been so seldom had recourse to; most probably its price* has deterred many chemists from availing themselves of it, or, perhaps, the immense danger, trouble, and uncertainty of result attending its preparation may have been the reasons of its being so little used.

Notwithstanding the statement in chemical works, that nitric acid "gave the same results as sulphuric" in acting on chlorate of

* I find that it is not purchaseable for less than 15s. per oz., and even then it is not very concentrated. The present price of perchlorate of potash is 4s. per oz. at C. Button's, Holborn Bars, and I do not know that it can be had cheaper elsewhere. This is a high price, but when we look at the danger attending its manufacture it cannot be considered exorbitant.

potassa, Professor Penny, in 1840, laid before the public his researches on the action of these two substances, in the course of which he discovered that the *chlorine and oxygen are not evolved in a state of combination but of mere mixture.* The action of sulphuric and nitric acid is, therefore, very different: with the former, the two elements are evolved with extreme violence, giving rise to that dangerously explosive compound Cl O^4 (peroxide of chlorine), while with the latter the decomposition proceeds with perfect tranquillity.

To prepare the perchlorate of potassa with absolute *safety*, we take 4 equivalents of chlorate and potassa, and 3 of real nitric acid (a sufficiency of hydrated nitric acid must necessarily be employed practically, as the real acid has never been isolated) on the application of a gentle heat the chlorate is seen to gradually disappear, and the oxygen and chlorine gases are either allowed to waste or are collected in suitable vessels. The solution must now be evaporated to dryness to expel all gaseous matter and the nitrate of potassa finally abstracted by cold water, leaving behind the nearly insoluble perchlorate in fine powder, greatly resembling potato starch. The result is 1 part of perchlorate and 3 of nitrate of potassa—the decomposition as follows:—

Materiel employed:—
4 (K Cl O^5) and 3 (NO^5).
Products:—
1 (K Cl O^7) and 3 (K NO^5),
Along with a mixture of
Cl^3 and O^{13}.

It will be seen that the gaseous products are not evolved in the exact amount to form the definite combination Cl O^4, therefore the most probable hypothesis to account for their non-union is to consider that the requisite amount of chlorine ought to have been 3¼ to saturate Cl^{13}, for the oxide is a compound of 4 atoms chlorine and 4 of oxygen—to which the proportions of 3¼ and 13 are strictly equivalent. Suppose that 4 atoms of oxygen have been just evolved; now, at the same period, only ¼ths of what is termed an "atom" (or combining amount) of chlorine will be separated, and as this is not an amount capable of entering into any chemical combination, the property of *elasticity* immediately comes into full operation, and the previously nascent oxygen and chlorine make their escape in the form of gas. This action is continued throughout the whole process, for, as soon as the next four equivalents of oxygen are generated, both those and the accompanying ¼ths of chlorine undergo the same metamorphosis, and no combination of Cl O^4 occurs.

That the nitric acid itself undergoes no decomposition or change, is a fact beyond all dispute, for the whole of it is found in the resulting nitrate of potassa; it would appear that it merely abstracts a portion of the base (¾ths of the whole) at the same time that the elements of the resulting super-acid chlorate arrange themselves into perchlorate and free oxygen and chlorine.

When iodate of potassa was acted on by nitric acid, no periodate was formed; the acid was merely decomposed into nitrous gas and oxygen, while the iodate remained behind as at first.

On substituting the *bromate of potassa*, no perbromate could be procured; the bromic acid of the bromate was completely decomposed into bromine and oxygen, while pure nitrate of potassa was found as the residue.

It would appear that, when oxygen and chlorine are evolved *at the same moment*, in the atomic proportion of 4 of the former to 1 of the latter, the definite compound, Cl O^4 is formed, but not otherwise; thus, in the old formulæ, these elements are evolved in the exact amount:—4 (SO^3) and 3 (KCl O^5) produce 2 (K, $2SO^3$), (K, Cl O^7) together with 2 (Cl, O^4).

In conclusion, I may state, that by adding a sufficiency of nitric acid, to make the proportion the same as in the sulphuric acid reaction, it has not the same effect, the surplus remaining behind, having acted neither in one way nor in another. It is, therefore, obvious that the old process is the cheapest, for it produces 1-3rd of perchlorate from a given weight of chlorate, while the new one gives only 1-4th, and the price of the nitric acid is greater. However, granting that the danger may be avoided by mechanical erections, or such like, still, *practically* no such amount as 1-3rd has ever been obtained, for the decripitating chlorate flits, and starts out of the vessel in large amount, and is consequently wasted. As to putting the materials into a retort, I have not been so fool-hardy as to try anything of the kind; I imagine from the many dreadful accidents that have happened, that *very few* chemists *now* attempt that plan. It is very probable that the *casualties* attending the last method would cause a deficiency of product in the aggregate, so that, on the whole, you may almost guarantee a larger amount by the new than by the older process; there is little possibility of waste, with proper care. Those, however, who wish to try the original formula, must bear in mind that the safest way is use a *shallow vessel*, heated in a *water bath*, so that the temperature shall not rise above the proper height; never use a naked flame. The process must also be conducted

in the open air, or the operator would, in all probability be suffocated by the dense vapors of the peroxide of chlorine.

Perchlorate of Potassa.—This interesting salt, whichever way it be procured, is in the state of a very fine crystalline powder, closely resembling potato-starch in powder. Contrary to expectation, it deflagrates with much less violence than the chlorate of the same base, in fact the nitrate almost surpasses it in this respect; the same remark is equally applicable to all the other perchlorates—they all deflagrate more feebly than the corresponding chlorates, although the former contain nearly half as much again of oxygen as the latter.

This salt forms the source from which we have to obtain all our perchloric acid. The separation by sulphuric acid proceeds tranquilly—there is neither decripitation nor explosion. It appears to be a very stable compound, and does not evolve gases with hydrochloric acid, as do the chlorate and nitrate. Fluosilicic acid answers best to prepare the perchloric acid, as distillation is unnecessary; however, it takes a day or two for the perfect precipitation of the fluosilicate of potassa.

Perchlorate of Soda is a deliquescent salt, and very soluble in both water and alcohol. If the chlorate of soda be ever made on the large scale, so as to enable chemists to prepare the perchlorate, the latter would prove of immense utility in chemical analysis, for it precipitates potassa from solutions of every other metallic oxide known, provided that alkali be present. I am told that, by recent improvements in the manufacture of the chlorate of potassa, the whole of the base is converted, and not a mere portion as formerly; most probably the soda salt could be produced in the same manner, and from this the perchlorate might be made; alcohol would separate the perchlorate from the nitrate of soda very readily.

The other perchlorates are all deliquescent and soluble in alcohol, with the exception of the perchlorate of lead, and the perchlorate of protoxide of mercury.

ON THE EXPLOSION OF BURNING FLUIDS.*

BY E. N. HORSFORD RUMFORD,
Professor in the University at Cambridge, U. S. A.

It has been maintained that several of the various preparations under the general denomination of burning fluids are, in certain conditions, explosive. It has been asserted by vendors, on the other hand, that they are not explosive. Wherein the misapprehension lies how the numerous accidents that have occurred in the use of burning fluids are to be explained, and by what precautions the repetition of these accidents may be prevented, have been subjects of experimental inquiry.

a. The burning fluids, as a class, are rectified spirits of turpentine, with an admixture of a small per centage of highly rectified spirits of wine, or of some other inflammable body readily soluble in turpentine or alcohol; *b.* turpentine, alcohol, and ether, when fired in an open vessel, burn at the surface so long as a supply of oxygen is kept up; *c.* a slight report attends the flash of flame at the commencement of the combustion; *d.* the accidents with burning fluids have ordinarily occurred during the filling of lamps from the cans, and always in the presence of flame from a burning lamp or other source.

In these facts (*a*, *b*, *c*, *d*) lies the explanation of the phenomena that have been observed.

It is well known that a mixture of hydrogen and oxygen, in the proportion of 2 vols. of the former to 1 of the latter, is eminently explosive, and that atmospheric air, in larger measure, may be substituted for oxygen with somewhat diminished explosive tendency of the mixture, an admixture of oxygen with the hydrocarbon, used for city illuminations, is explosive; atmospheric air may be substituted for oxygen, as in the case above, with the like effect.

The above considerations suggested the idea that, in the chamber, over the burning fluid in the flask or can from which the lamps are filled, there might be an admixture of the vapor of the burning fluid in such proportion with atmospheric air as to make it susceptible of explosion. To test the value of this suggestion, experiments were made with alcohol, ether, and a kind of burning fluid in general use.

EXPERIMENT 1.—A current of air was directed into the upper part of a loosely-stoppered half-filled laboratory glass spirit lamp while burning, causing, thereby, a mixture of alcohol vapor and air to rush past the flame. After a moment or two, the jet took fire, and was instantaneously followed by explosion. This result was uniform.

EXPERIMENT 2.—After permitting a drop of alcohol, in a large glass flask with a small neck, to evaporate for an instant, upon applying flame to the mouth, explosion resulted frequently, though not so uniformly as in experiment 1.

* Read before the American Academy, Oct., 1849.

EXPERIMENT 3.—Ether, similarly treated in a glass flask, yielded less uniform results, because, probably, of the greater difficulty of obtaining the proper mixture of ether and air.

EXPERIMENT 4.—A kind of burning fluid in extensive use, and said by the vendors to be not explosive, was subjected to similar experiments with still less frequent affirmative results. They were, however, sufficient to show that explosions with it are possible. Similar experiments have been made with another variety of burning fluid by Dr. Morrill Wyman, of this city (Cambridge), with like results.

It is, therefore, established that when the proper amounts of burning fluid, vapor, and atmospheric air are mixed together, as they may be in the upper part of a partially-filled can, or receiver, and a flame is brought sufficiently near, explosion must result. If the quantity of mixed gases be large, the explosion may cause the destruction of the containing vessel; or, if that remain entire, it may drive out a portion of the fluid, which, taking fire, may cause more or less injury.

The cause of safety has been pointed out by the dealers in these articles for illumination. It is to fill the lamps, the tops of which are without special air-holes, and which screw on in the absence of flame by daylight, for example, in which case no explosion can occur.

Accidents similar to those with burning fluids have taken place in the use of the so-called air-tight stoves for burning wood. After the wood has been fired and the supply of air for some time shut off, on re-opening the draft (and sometimes without there is reason to believe) occasional explosions of great violence have occurred, attended sometimes with the partial destruction of the stove. The probable explanation is the following:—

After firing the wood and shutting off the draft destructive distillation commences.

Inflammable gases issue from the wood, which, mingling with air derived from the pipe, or remaining still unconsumed, furnish a moisture becoming gradually more and more explosive, until, at length, the proper proportions having been attained, the incandescent coal, or a jet of flame, causes explosion.

As these accidents are not of frequent occurrence, it may be found that the probability of producing inflammable gases in the required quantity is less with some varieties of wood than with others.

ON THE COMBUSTION OF HYDROGEN BY CHLORINE, BROMINE, IODINE, AND OXYGEN.

BY M. A. BUSSY.

THE conditions under which the combustion of hydrogen in chlorine and oxygen takes place, and the nature of the products resulting from this combination, have long been known. There is little new light to be thrown on the subject. I here merely wish to indicate a new method of making these experiments, which I have been accustomed to use, and which allow of burning hydrogen in a constant stream, and which avoids explosion without at all altering the evidence of the results. The facts, in this case, can easily be established in all their details, by constructing an ordinary apparatus for the production of hydrogen gas, and affixing to it a bent tube tapered at one end. When the gas disengages itself in a regular current, it should be ignited, and the end introduced into a flask, or even a simple test glass, filled with chlorine; the gas continues to burn, the flame is modified in color and size, it becomes larger and takes a bluish-white tint, at the same time a large quantity of the white vapors of hydrochloric acid is seen issuing from the top of the receiver; combustion continues in this state so long as a sufficient quantity of chlorine remains in presence of the hydrogen. If, after combustion, some tincture of litmus is poured into the test glass, it becomes strongly reddened by the hydrochloric acid adhering to the sides of the glass. It is needless to add that, if it be desirable to continue the combustion for a longer period, it will be necessary to arrange the apparatus in such a manner as to introduce into it, by means of a lateral tubelure at the bottom, a current of chloride, to replace that which has been absorbed by combustion. It would be equally easy to collect the hydrochloric acid formed, but these arrangements, which complicate the apparatus, add nothing to the demonstration; the burning always continues long enough, even in a test glass of small dimensions, to make the experiment perfectly conclusive; care should be only observed that the tube for the hydrogen gas should be inserted into the test glass in such manner that the chlorine should be burnt layer by layer. If the end of the tube were quickly inserted to the bottom of the test glass, the larger portion of the chlorine would be carried off by the current of hydrochloric acid; by the increased temperature which is produced, the combustion, being at first very violent, quickly slackens for want of chlorine.

The same experiment may be made wit

equal success in the vapor of bromine, by putting a quantity of it into a test glass, at a temperature of about 104°, so as to insure a constant supply of the vapor to replace that which is absorbed by combustion; phenomena, analogous to the preceding, are produced, the hydrogen burns with a constant flame, forming hydrobromic acid.

Iodine, kept in fusion in a test glass by means of a spirit lamp, produces a sufficiency of vapors of iodine, but they are unfit for burning hydrogen in the conditions we have pointed out above. The flame of hydrogen plunged into this vapor appears to be very much modified, but it is extinguished as soon as separated from the atmospheric air, and in placing it even in the most favorable conditions, no trace of hydrobromic acid is perceptible. But, on the contrary, if instead of chlorine, bromine, or iodine, oxygen gas is used, the hydrogen flame is infinitely brighter than in any of the preceding cases; the temperature is instantly raised, and if the experiment is prolonged for a few moments, the tube softens and becomes obstructed.* These simple experiments show that the same substance burnt indifferently in bodies of very different combustible powers, without the most habitual form of the phenomenon; being apparently modified, that is to say without ceasing to produce in these different cases heat, light, and flame as in ordinary combustion.

The same experiments also furnish an approximate idea of the affinity of hydrogen for each of the four bodies in question, if it be permitted to measure that affinity by the activity of combustion and the stability of the products formed; thus oxygen evidently develops a much greater heat and light than chlorine; the latter, notwithstanding, burns hydrogen in the same manner as oxygen, the combustion once commenced is invariably kept up in pure chlorine; it is altogether independent of the presence of air, and the chlorine is completely transformed into hydrochloric acid.

With bromine, the temperature produced by the combination does not appear to be sufficiently high for combustion to maintain itself. Without the aid of additional heat hydrogen does not burn in the vapor of bromine, except a certain quantity of air be present, but if the flame is lowered to the bottom of the test glass it becomes enfeebled and is soon extinguished.

At the same time it cannot be doubted that the bromine contributes a portion to the combustion for the reason that, like chlorine, a quantity of acid vapors is produced, which are capable of condensation. But the combustion of hydrogen by bromine is evidently partial and incomplete; it can be kept up under the conditions named only by the aid of a certain external temperature.

With iodine combustion is altogether impossible, under the same circumstances: it does not form a trace of hydryodic acid.

* Wet hydrogen could be employed as well as dry by passing it through a tube containing chloride of calcium, but none of the preceding effects are modified.

FORMATION OF SUCCINIC ACID BY OXIDATION OF BUTYRIC ACID.*

(*Extract of a note by M. Dessaignes.*)

M. Gerhardt, in his *Précis de Chemie Organique*, has observed that parallel to the series of monobasic fatty acids, whose general formula is $C^m H^m O^4$, we may construct a series of bibasic acids, whose general formula is expressed by $C^m H^{m-2} O^8$. Nearly all the acids of these two parallel series are produced simultaneously when fatty bodies of high equivalent are oxidised by nitric acid; and it is conceivable that each term of the bibasic series is formed by a simple oxidation of the corresponding term in the monobasic series. But, except as regards acetic and oxalic acid the possibility of this transformation remains to be demonstrated experimentally.

Butyric acid, in the series of fatty acids, corresponds to succinic acids of the other series. I am, in fact, enabled to produce the second of these acids by the oxidation of the first. In an apparatus, consisting of a retort, a long adopter, and a receiver, ground into one another with emery, and adjusted without a cork, I heated about 30 grammes of very pure butyric acid prepared by the fermentation of flesh and fecula with twice its bulk of nitric acid of the density of 1·40. The apparatus was so inclined that the condensed vapors of the butyric acid fell back into it continually, and nitric acid was added from time to time. Although the mixture was continually surmounted by a red atmosphere of nitrous gas, the action was very slow, and it was far from finished at the expiration of 10 days of 24 hours each. Not perceiving any cessation of the red vapors, I distilled the liquor so far until I obtained a crystalline residue. This residue was impregnated with a matter which attracted moisture from the air from which I could not free it by treating for a long time on a

* *Comptes Rendus*, No. 3, Jan. 21, 1850.

sand bath, I pressed it strongly in paper and I thus obtained it sufficiently pure to be submitted to investigation. I readily recognised that its crystals presented all the physical characters and all the re-actions of succinic acid. I had not sufficient matter to purify it completely and to make a direct analysis, but I prepared and calcined the salt of silver which appeared to me to afford the greatest purity :—0 gr., 471 left 0 gr., 303 of silver; which gave to 100 parts 64·33 silver; calculation indicates 65·05.

ON TWO NEW SALTS OF CHROMIC ACID.*

BY ARCHIBALD DUNCAN, JUN., ESQ.

In 1827, Dr. Thomson, in a paper on the compounds of chromium ("Philosophical Transactions," 1827), described the double-salt potassa chromate of magnesia—(KO CrO^3, MgO CrO^3, 2 HO), formed by digesting a bichromate of potassa in solution with carbonate of magnesia. Mr. Duncan obtained a corresponding lime salt by the following process :—A boiling solution of bichromate of potassa was poured on recently-slaked lime, in a tall vessel. The undissolved lime having subsided, the supernatant fluid, which was of a lemon-yellow color, was drawn off with a syphon, and slowly evaporated in a hot air stove, at 80° F. During the first two days of the evaporation, crystalline crusts, of an orange salt, were formed on the surface of the liquor, and required to be frequently removed. After this time, however, these crusts ceased to be produced, and crystals of a yellow salt began to appear at the bottom of the evaporating basin, and in two or three days more a mass of beautiful crystals was obtained. The proportion of the orange to the yellow salt depends much on the temperature employed in the evaporation. In one experiment, the heat was raised to boiling, and no yellow crystals were obtained, the orange crusts continuing to separate as fast as removed.

Yellow potassa chromate of lime crystallises in lemon-yellow four-sided oblique prisms. It is soluble in water, and insoluble in cold alcohol; it is formed in the latter part of the process above described.

The salt, when ignited, fuses; and, on cooling, the mass has a crystalline aspect, and is quite soluble in water.

The average of several analyses gave the following result :—

* *Philosophical Magazine.*

	Experiment.	Calculation.
Chromic acid..	51·840	52·52
Potash	23·900	24·24
Lime	14·950	14·14
Water.....	9·600	9·10
	100·290	100·00

This corresponds nearly with the formula KO CrO^3, CaO CrO^3 + 2HO, the water being slightly in excess. It, therefore, is a parallel compound to the salt of magnesia described by Dr. Thomson.

Orange Potassa Chromate of Lime.—This salt is soluble in water. The mean of these analyses yielded the subjoined result :—

Chromic acid	52·070
Lime	23·990
Potash.....	17·550
Water	6·230
	99·840

This nearly approaches to the formula $3KO^7$ CaO Cr O^3, 5HO. It does fuse when ignited; and when cool, is of a yellow color. It does not altogether redissolve in water, and thence it appears to have undergone decomposition.

ECONOMICAL PREPARATION OF CHLORIC ACID, AND THE CHLORATES OF THE ALKALINE AND EARTHY BASES.

To the Editors of the Chemist.

Gentlemen—No inorganic salts are more difficult and troublesome to prepare than the chlorates; unlike the muriate, sulphate, &c., the acid is not transferable from the chlorate of potash by double decomposition.

I have found that hypochlorous acid (Cl O) is capable of transforming the chloride of potassium entirely into chlorate of potash, chlorine gas being given off. All the other chlorates may be made in the same way, and without the loss or waste of either base or chlorine, for the latter is brought back again, to form once more the ClO.

The most suitable arrangement for working on the large scale will be to have the series of Woolf's bottles placed as usual, but containing, *alternately*, solutions of sulphate of soda, and of muriate of the base, the chlorate of which is in request. The action is this—Chlorine is produced, as in the old method, but instead of passing to the alkali bottles it enters a solution of sulphate of soda, and is by that means converted into hypochlorous acid, which, passing into the next bottle, containing muriate, chemical action occurs, and it changes again into chlorine, which, meeting the sulphate of soda in

the next one to it, becomes once more hypochlorous acid, ready to act upon the adjoining muriate; these alternations of the solutions are repeated as often as it may be deemed necessary. When the sulphate of soda has become nearly transformed, it ought to be taken out and heated; the products are bisulphate of soda and muriate of soda, which, on the application of heat, are changed into neutral sulphate of potassa and free hydrochloric acid, the former being used over and over again, while the latter is collected to engender fresh chlorine for future operations. Heat causes—

1 (Na $2SO^3$) and 1 (Na Cl H)

to resolve into

2 (Na SO^3) and 1 (Cl H).

The preparation of Cl O from sulphate of soda and chlorine, is a discovery of great importance, the credit of which is due to Mr. Williamson. It affords the most economical way of producing that acid, to whatever use or purpose it may be applied. Chalk may be substituted for sulphate of soda; in this case the decomposition is explained thus—

2 (Ca O, CHO) + 4 (Cl)

changed into—

2 (Ca, Cl) + 2 (Cl O) + 2 (CHO).

The carbonic acid is no great detriment, for it has no chemical action either on the materials or on the salts undergoing formation.

Chloric acid.—Perhaps the best way to obtain this will be to decompose the chlorate of baryta with dilute sulphuric acid. Or it may be found more economical, in the long run, to separate it from the chlorate of soda by means of oxalic acid; binoxalate of soda and free chloric acid are the products, the former precipitating itself completely, if the vessel be cooled by a freezing mixture. The latter process is, unfortunately, not applicable to the potassa salt, or we should have at once a most ready, cheap, and convenient method of procuring the acid from the commercial chlorate.

In conclusion, I wish to direct the attention of chemists to the application of chloric acid as an oxydising agent, for up to this time it has been scarcely at all used, yet the study of its varied and marked action would, no doubt, lead to very remarkable results. It is an interesting acid, and far exceeds nitric acid in its oxidating properties. Chemists will find that many new products will be hereafter obtained by its employment. In their organic investigations in particular will it lend its most valuable aid, causing many wonderful and unlooked-for transformations.

I am, Gentlemen,
Your very obedient servant,
T. W. N.

PRESENCE OF IODINE IN ALUMINOUS SCHISTS.*

Some years ago, Mr. Forchammer put forth an ingenious notion as to the part performed by fuci in the formation of aluminous schists. This consisted in supposing that the fuci, after having accumulated in their substance the sulphates contained in the sea water, after they are dead, convert the sulphate of potassa into sulphuret of potassium; this, in its turn, precipitates the iron contained in the sea water in the state of sulphuret of iron, which mix with the clay and other substances, some of which are organic, and owing to the decomposition of the fuci. Analysis, by demonstrating the presence of iodine in aluminous schists, has added a new and powerful argument in favor of this hypothesis, which Mr. Forchammer has already well established by numerous observations. The ash of the fuci contains, in fact, a considerable quantity of iodine, which might lead to the supposition that this substance would also be found, at any rate in small quantity, in these deposits, if the fuci really perform the part in the formation of these schists which Mr. Forchammer attributes to them. Mr. Genteles, who was engaged, in 1846, in investigations concerning the manufacture of alum, has separated iodine from the aluminous schists of Latorp in Sweden. This discovery, coupled with that of M. Dufios, of the presence of iodine and bromine in the coal of Silesia, will be sufficient to call the attention of geologists to the confirmation they furnish of Mr. Forchammer's ideas concerning the formation of aluminous schists.

ON PIPERINE.†

BY MESSRS. WERTHEIM AND ROCHLEDER.

Chemists are still in doubt as to the true formula and atomic weight of piperine. Messrs. Wertheim and Rochleder have succeeded in preparing the double hydrochlorate of piperine and platinum, the existence of which leaves no doubt as to the alkaline nature of piperine. This salt crystallises in fine orange crystals, very sparingly soluble in water, but soluble in alcohol. Put in contact with large quantities of water, it appears to be decomposed; hydrochloric acid is liberated, and piperine, unaltered in appearance, separates. It may be dried at 212° F., without being decomposed; at a

* Svanberg's "Jahresbericht."

† *Annalen der Chemie und Pharmacie*, lxx., 58.

rather higher temperature, it fuses and decomposes, swelling up. Its composition is represented, according to Messrs. Wertheim and Rochleder, by the formula—

$$C^{70}\ H^{97}\ N^3\ O^{10} + Cl\ H + Pt\ Cl^2,$$

from which we deduce for piperine the formula—

$$C^{70}\ H^{97}\ N^3\ H^{10}.$$

On comparing this formula with that which may be deduced from the analyses of MM. Regnault and Laurent, we find that the latter differs from the former only by the elements of the two equivalents of water, which amounts to saying that crystallised piperine, such as Regnault and Laurent analysed, contains two equivalents of water of crystallisation, and that its composition is represented by the formula—

$$C^{70}\ H^{97}\ N^3\ O^{10} + 2\ HO.$$

MM. Wertheim and Rochleder have observed, in the course of their investigations, a very interesting reaction. In distilling piperine in an oil bath, at a temperature of 300° to 320° F., with three times its weight of lime, an oily, alkaline liquor is obtained in the receiver, possessing all the properties of picoline, $C^{12}\ H^7\ N$, discovered by Mr. Anderson. From the alkaline residue remaining in the retort, the authors extracted, by successive washing with water, cold alcohol, and hydrochloric acid, a body of resinoïd appearance, and capable of being precipitated under the form of flakes of a bay yellow color, when water and a little hydrochloric acid are added to its solution in absolute alcohol. The authors represent the composition of this body by the formula $C^{120}\ H^{97}\ N^3\ O^{70}$, and interpret, in the following manner, the reaction which gives rise to it:—

$$\underbrace{2\ C^{70}\ H^{97}\ N^3\ O^{10}}_{\text{Piperine.}} = \underbrace{C^{12}\ H^7\ N}_{\text{Picoline.}} + \underbrace{C^{120}\ H^{97}\ N^3\ O^{80}}$$

At the conclusion of their memoir, they enter upon the question of the constitution of piperine itself, which they regard as a kind of pseudo salt, containing the elements of piperine united to an organic group formed of

$C^{68}\ H^{80}\ N\ O^{10}$,

$C^{70}\ H^{17}\ N^3\ O^{10} = C^{12}\ H^7\ N + C^{68}\ H^{80}\ N\ O^{10}$;*

or else, admitting an analogy between the composition of this body and that of the ammoniacal salts,

$$C^{70}\ H^{97}\ N^3\ O^{10} = C^{12}\ H^7\ N + C^{68}\ H^{89}\ NO^9 + HO.$$

MM. Wertheim and Rochleder have extended this hypothesis concerning the constitution of piperine to those of narcotine and of the bases derived from it, cotarnine and narcogenine.

Narcotine may, indeed, be regarded as containing two conjugate groups, cotarnine united to a non-nitrogenous body — $C^{20}\ H^{12}\ O^8$.

$$\underbrace{C^{46}\ H^{25}\ NO^{14}}_{\text{Narcotine.}} = \underbrace{C^{20}\ H^{12}\ O^8}_{\text{Cotarnine.}} + \underbrace{C^{26}\ H^{13}\ O^{54}}_{\text{Cotarnine.}} + HO$$

If the formula of narcogenine be doubled, it is easy to establish a very simple relation of composition between this base, narcotine and cotarnine. Narcogenine would, in fact, be a conjugate combination of one molecule of cotarnine with one molecule of narcotine, plus 1 equiv. of water.

$$\underbrace{C^{72}\ H^{38}\ N^2\ O^{20}}_{\text{Narcogenine.}} = \underbrace{C^{46}\ H^{25}\ NO^{14}}_{\text{Narcotine.}} +$$

$$\underbrace{C^{26}\ H^{12}\ NO^5}_{\text{Cotarnine.}} + HO.$$

By simplifying these expressions, we should have—

Narcotine = $C^{12}\ H^{12}\ O^8$ + Cotarnine + Aq.

Narcogenine = $C^{12}\ H^{12}\ O^8$ + 2 Cotarnine + Aq.

SEPARATION OF ANTIMONY AND ARSENIC.†

BY M. ULLGREN.

When we have arsenic and antimony in solution in hydrochloric acid, the arsenic is converted by means of chlorine, or an alkaline hypochlorite, into arsenic acid; as great excess of tartaric acid is added to the solution, then a soluble salt of magnesia, and, finally, the solution is saturated with ammonia. Ammoniaco-arseniate of magnesia is then precipitated, but no antimony. The precipitate is washed with dilute ammonia.

* The assimilation of this kind of combination with salt, or even with what the authors call a pseudo salt, does not appear to me very happy. It seems to me that, admitting the hypothesis which the authors start concerning the constitution of piperine, it would have been more correct to refer this kind of combination to the type presented to us by this osinnamine and the basic bodies obtained by adding an ammonia to the cyanic ethers. In these cases we see, in effect, a neutral body become alkaline in joining with the elements of a powerful base. The result of this reaction, far from being a salt, constitutes a much more intimate kind of combination, a conjugate organic base. — A. Wurtz.

* Formula proposed by M. Wertheim.

† *Repertoire de Pharmacie.*

The separation being thus effected, the two bodies may be readily estimated by the ordinary method. However, to estimate the arsenic without it being necessary to treat the precipitate first with sulphurous acid, then with hydrochloric acid and sulphuretted hydrogen, the precipitate is dissolved in nitric acid, the solution is evaporated to dryness in a platinum crucible, and a certain weight of magnesia is added to it; the whole is acetated with very little water, so as to form a thick mass; it is evaporated to dryness and calcined. In this manner the ammonia is expelled by the magnesia, without occasioning any reduction of the arsenious acid, which might take place if the nitric solution were simply evaporated, and if the residue were calcined to destroy the nitrate of ammonia.

The magnesia added being deducted, the weight of the acid is calculated from the weight of the residue, which contains ($As^2 O^5$, 2 Mg O). 100 parts of this salt correspond to 73·593 parts of $As^2 O^5$, or 48·018 parts of arsenic.

ON THE WATER OF THE RIVER THAMES.*

Our facetious friend *Punch* has given us in this year's almanac a *fish*-eye view of the contents of old Father Thames. We lay before our readers three analyses of Thames water, undertaken by some of the students of the College of Chemistry, which may not be altogether uninteresting, premising that the more highly the water is charged with soluble and insoluble organic matters and chloride of calcium, the more unwholesome and deleterious to health it becomes.

Analysis of the water as it is found before it has been polluted by the London drains and sewers, collected from the middle of the river, two hours after high tide, in the neighbourhood of Twickenham, 14 miles from London-bridge. By Mr. Clarke.

	In 100 litres. Grms.	In a gal. Grs.
Temperature, 49·1 F.		
Sulphate of potash ..	·9542	·66794
Sulphate of soda	2·8573	2·00011
Sulphate of lime	·6439	·45073
Chloride of calcium ..	2·5003	1·75021
Carbonate of lime ..	18·2278	12·75946
Carbonate of magnesia	1·4673	1·02711
Silicic acid	·3902	·27314
Phosphoric acid	traces	traces
Alumina	traces	traces
Carried forward..	27·0410	18·92870

* From the *Patent Journal*, Feb. 2, 1850.

	In 100 litres. Grms.	In a gal. Grs.
Temperature, 49·1 F.		
Brought forward..	27·0410	18.92870
Carbonate of oxide of iron	traces	traces
Soluble organic matter	3·2648	2·28536
Insoluble organic matter	1·7069	1·19483
	32·0127	22·40889
Direct determination of fixed constituents	32·1285	22·48995

From the foregoing analysis it appears that the principal ingredient in Thames water in the neighbourhood of London is carbonate of lime, held in solution by free carbonic acid, and which would therefore be deposited upon continued boiling.

Analysis of the water taken at London-bridge, about half an hour after high water. By Mr. Ashley.

	In 100 litres. Grms.	In a gal. Grs.
Temperature, 55·4 F.		
Sulphate of potash ..	·385	·2695
Sulphate of soda	4·436	3·1052
Chloride of sodium ..	3·389	2·3723
Chloride of magnesia	·114	·0798
Chloride of calcium ..	9·963	6·9741
Carbonate of lime ..	11·595	8·1165
Silicic acid	·177	·1239
Phosphoric acid	traces	traces
Alumina	traces	traces
Insoluble organic matter.....	6·656	4·6592
Soluble organic matter	3·340	2·3380
	40·055	28·0385
Direct determination of fixed constituents..	40·843	28·5901

Analysis of the water collected at Greenwich from the middle of the river, exactly opposite to the hospital, and just after the turn of the tide. The wind blew strong down the river, and had a material effect in keeping back the sea water at that particular time. By Mr. Bennett.

	In 100 litres. Grms.	In a gal. Grs.
Temperature, 37·4 F.		
Sulphate of potash ..	1·9552	1·3710
Sulphate of soda	5·5937	3·9224
Sulphate of magnesia	0·7808	0·5475
Chloride of magnesium	1·6374	1·1482
Chloride of calcium ..	2·3205	1·6272
Carbonate of lime....	20·5353	14·3997
Silicic acid	1·1349	0·7958
Phosphate of alumina	traces	traces
Iron	traces	traces
Organic matter.....	5·8200	4·0810
	39·7778	27·8928
Direct determination of fixed constituents..	39·9859	28·0387

Deducting from the total per centage of free carbonic acid amounts to 0·014035, corresponding to 7161·813 cubic centimetres in 100 litres, or to 19·8535 cubic inches in an imperial gallon.

The arrangements, as above, do not exhibit any chloride of sodium in the water, which, no doubt, must exist as such, in the Thames at Greenwich, especially at high water.

In the same manner, sulphate of lime is undoubtedly present, though not shown in the table. But as the precise form, or the proportions in which the individual constituents are distributed in a mixed solution, is not known—for experiment proves they may be variously associated in solution according to the degree of concentration—every arrangement must be more or less hypothetical. We have, therefore, adopted the principle followed in the preceding analyses, of combining the strongest acid with the strongest base, as affording the best means of comparison.

The general features of the foregoing analyses exhibit a large increase in the amount of fixed constituents, as compared with the water at Twickenham, but not as compared with that from London-bridge.

This appears intelligible from a portion of the large amount of organic matter found at London-bridge having disappeared in the further course of the river. The total amount of fixed constituents being, however, but slightly diminished; the rather considerable decrease of organic matter must be supplied by something that the water has taken up. We find this to consist principally of the alkalies, magnesia, and carbonate of lime, the latter being taken up and held in solution by carbonic acid. In looking for a source of the additional amount of carbonic acid, we think it may be found in the decomposition of the various organic matters, both soluble and insoluble, which are daily carried into the Thames, and of which, as our analyses show, a portion disappears in the progress of the river from London-bridge to Greenwich; although this diminution may have been partly occasioned by the influx of sea water. By comparing the different results of the several analyses, it becomes evident, likewise, that the waters of the river are affected by other local circumstances, probably at both these stations. It may be mentioned, that there are several chemical works which pour their refuse into the river, both above and below the point where the water which is the subject of the present analyses was taken.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

ON THE CAUSES OF THE GENERAL PRESENCE OF PHOSPHATES IN THE STRATA OF THE EARTH, AND IN ALL FERTILE SOILS; WITH OBSERVATIONS ON PSEUDO-COPROLITES, AND ON THE POSSIBILITY OF CONVERTING THE CONTENTS OF SEWERS AND CESSPOOLS INTO MANURE.

BY THE REV. W. BUCKLAND, D.D., DEAN OF WESTMINSTER.

Professor Liebig, five or six years ago, invited the attention of agriculturists to the possibility of applying to the same use as bone dust and guano the fossil bones and coprolites which occur together in certain beds of the lias formation. This invitation took place not many months after I had the honor of conducting him to the well-known bone bed in the lower regions of the lias, at the Aust Passage Cliffs, on the left bank of the Severn, near Bristol, where two beds of lias (each from one to two feet thick) are densely loaded with dislocated bones and teeth and scales of extinct reptiles and fishes, interspersed abundantly with coprolites derived from animals of many kinds, which seem to have converted that region into the cloaca maxima of ancient Gloucestershire, at the time of the formation of the lias. Coprolites are also dispersed plentifully through the strata of many other parts of the lias, *e. g.* on the coast at Lyme Regis; but neither there nor in the bone bed at Aust Passage, is a sufficient quantity accessible, at a cost that would repay the digging, for the express purpose of collecting these mineralized fragments of skeletons and fæcal balls of digested bones for use as a substitute for recent bone-dust or guano.

Geologists have long been acquainted with the abundant occurrence of rolled fragments of the bones and teeth of large quadrupeds, and of whales and sharks, and also of the bones and teeth of many marine fishes, in the tertiary beds of gravel and shells, called crag, in the counties of Norfolk and Suffolk; and in 1846, Professor Henslow laid a paper before the British Association at Cambridge, on the abundant occurrence of

the ear-bones of whales in the crag beds of Felixstow on the coast of Suffolk, together with large quantities of rolled pebbles of phosphates of lime (which he then supposed to be coprolites) among the miscellaneous gravel and shells that compose the bulk of the crag formation.

About this time also, Professor Solly's analysis of these supposed coprolites proved their chemical composition to be nearly identical with that of real coprolites from the lias; and the attention of agriculturists was invited to their use as a manure of nearly equal value with guano or bone-dust. Mr. Solly's advice to agriculturists to make use of this newly-discovered storehouse of fertility has been duly responded to; and many thousand tons of these pebbles and bones have been collected from the shore near Felixstow; whilst many occupiers of inland farms near Felixstow and Woodbridge have been and are still collecting similar pebbles from superficial beds of gravel of the crag formation, varying in thickness from one foot to many feet, and extending over areas of variable extent and irregular forms, modified by the sweeps of currents, by which the bottom of the tertiary sea was affected during the formation of the crag. The contents of these gravel-beds are of three kinds:—1. Silicious sand, and rolled chalk, flints, and miscellaneous gravel. 2. Marine shells, and rolled bones and rolled teeth of land quadrupeds and fishes. 3. Rolled pebbles, resembling cropolites, among many thousands of which, in the collections of Professor Henslow and Professor Solly, I have never found one that has just pretensions to that name and title; although, from this accidental fictitious resemblance, the name of coprolite manure has obtained an agricultural and commercial currency which now cannot be withdrawn, but to which the name of pseudo-coprolite would be more appropriate; better still would be the name of phosphorite, which I shall use in the following observations.

Mr. Lawes has established, on the east bank of Deptford Creek, near Greenwich, very extensive works for grinding to powder these false coprolites or phosphates, and my attention will be directed—1. To the origin of the pebbles, and the causes which have charged them with phosphoric compounds. 2. To the causes that have dispersed similar phosphoric compounds through nearly all rocks and soils. 3. To the possibility of imitating the natural processes that cooperated in their production, and of converting the valuable phosphates of our sewers to the manufacture of a similar manure, by placing sewage water in conditions analogous to those which attended the formation of phosphates in the crag, and in other strata formed at the bottom of ancient seas and lakes.

We may here observe, that the presence of peroxide of iron, which pervades all these pebbles, and encrusts, or pervades, also, all the rolled fragments of bones and teeth, and the shells of the crag formation, may be an accident not essential to the production of the phosphorites, though possibly auxiliary to, or connected with it.

I believe the essential condition was the admixture (in a fluid or semi-fluid state) of all the now consolidated ingredients of the marlstone and of the septaria (which we use to make our Roman cement), namely, of clay, carbonate of lime, protoxide of iron, in a state of mud on the sea bottom, at the time of the disengagement of phosphoric compounds from the dung and putrefying bodies of fishes, and of molluscous animals and marine worms, at the bottom of the seas in which the deposition of the London clay was going on. These conditions that attended the deposition of the material of the London clay were similar to those attending the deposits of sedimentary mud (subsequently converted to beds of clay and marl) in all geological formations, since the waters were first peopled with swimming creatures of ten thousand kinds, with creeping things innumerable, both small and great beasts.

From the first creation of fishes to fill and multiply in the waters, there must have been a never-ceasing deposition of phosphoric compounds in every bed of mud that was in progress of accumulation at the bottom of all inhabited portions of seas and lakes and rivers; and thus the fæcal dejections of all subaqueous animated nature must, by their decomposition, have supplied daily and hourly accessions of matter convertible to phosphorite. There must have been also a further never-ceasing supply of phosphates from the decay of the bodies of all these animals after their death, *i. e.*, from the dead bodies of all fishes and molluscs and sea-worms that were not devoured by other animals.

From these twofold sources incessant additions of phosphoric matter must at all times have been falling into decay, and mixing phosphoric compounds with the earthy sediments at the bottom of all inhabited waters; and these incessant and almost universally-diffused supplies of animal exuviæ must, in the act of decomposition, have been continually evolving phosphoric compounds in the nascent state, which is the state most apt to enter into new chemical combinations. Where the bottom of the sea was covered only with siliceous sand, no phosphoric combinations could take place;

and hence the barrenness of the great siliceous sandy deserts of the world; but, wherever the bottom of the water contained (in an unconsolidated state) the ingredients of future marl or marlstones, or septaria, conditions were present favorable to the formation of the new combinations of phosphorite.

Now, as both phosphate and carbonate of lime are soluble in water charged with carbonic acid, and as carbonic acid is one of the most abundant substances in nature, evolved under all kinds of animal and vegetable decay, it follows that wherever decomposition of fæcal dejections, or of dead animals or of sea-weeds was going on, over the entire bottom of all the ancient seas, and great oceans, beds of these cumulative additions in every day and every hour of antediluvian time, became the grand receiver general and cloaca maxima of the terraqueous globe, a universal laboratory and conservative storehouse of universally dispersed manurac for the future corn fields and pastures of the earth, when these ancient sea bottom should be raised up to become dry land, and in process of time be converted into vine-yards and olive-yards, and land of wheat and barley, for the sustentation of man, and of land animals of higher functions and higher organisation than those multiplied generations of marine reptiles and fishes and worms and creeping things, which were the appointed purveyors of future food for man, destined by the functions of their daily digestion, and of their life and death and decay, to lay up stores of universal fertility in the deep foundations of the earth, and to prepare the nascent strata in the very act of their construction, to become, in due time, a grateful soil to reward the labors of the agriculturist.*

As the processes we have been tracing in the London clay are types of operations that have more or less pervaded all deposits formed under water, in all formations, I will state further particulars respecting this London clay. Phosphoric matter, elaborated in the bodies of animals, has not only become combined with the earthy ingredients of its larger septaria, the Roman cement stones, but also with the millions of minor concretions that crowd the London clay, and which often envelope fragments of some animal or vegetable that formed a nucleus around which the materials of these concretions were collated and aggregated while in a fluid state. Many of these half calcareous concretions in the London clay, contain enough of phosphoric matter to place them in the family of pseudo-coprolites, the history of which, in other formations, I shall presently describe. We are now considering the fate and fortune that has attended these minor phosphoriferous concretions of the London clay. From their matrix in the London clay they were dislodged by the waters of the seas of the first period, and accumulated by myriads at the bottom of those shallow seas where is now the coast of Suffolk. Here they were long rolled together with the bones of large mammalia and fishes, and with the shells of molluscous creatures that lived in shells. From the bottom of this sea they have been raised to form the dry lands along the shore of Suffolk, whence they are now extracted as articles of commercial value, and ground to powder in the mills of Mr. Lawes, at Deptford, to supply our farms with a valuable substitute for guano, under the accepted name of coprolite manure.

But it is not certain that these pseudo-coprolites collected all their phosphates whilst they were in the London clay. It is possible that many, if not all of them, and also many fragments of the larger septaria, which we find rolled and broken in the crag, may have absorbed a larger dose of phosphorus than they contained before they were washed out of their matrix in the London clay, from the dejections and decaying bodies of fishes and molluscs and worms that inhabited the tertiary sea, at whose bottom they were for a long time rolling, while the gravel of the crag was in process of formation.

The bodies of the molluscous creatures that inhabited the very shells of which the crag is composed, must have given out phosphoric compounds during their decay, which may, by absorption, have supplied additional phosphoric matter to that which these concretions brought with them from their matrix in the London clay. Experiments are wanting to show whether concretions of other fragments of marlstone,

* This self-same process, which has been made to lay up in every stratum, during the act of its formation, stores of fertility for the then future lands and continents, produced a simultaneous reaction advantageous to the sanitary state and habitability of the waters of the sea, for had not this or some other process of purification been in continual operation, from the time when living things of all dimensions, from the infusorial animalcules to the sharks and great sea lizards and whales (Enaliosauri and Ceteosauri), were first created to inhabit the sea, the exuviæ of these myriads (notwithstanding diffusion) would, in a few centuries, have tainted all oceans and waters with impurities exceeding those so much complained of in the waters of the Thames at London Bridge.

and of marl, and chalk, and soft limestone, bathed in sewage water, mixed with salt enough to equal that in sea water, and with peroxide of iron and burnt clay, and at a temperature approaching the probable warmth of the shallow sea water in which the crag was formed, may absorb, and form similar phosphoric compounds from the ingredients of sewage. I earnestly commend such experiments to the care of the many accomplished chemists who are now directing their attention to sanitary and agricultural improvements.

There seems to be little doubt as to the power of the chemical agents I have spoken of, the chief difficulty lies in the time required to effect the desired combinations. Experiments on this subject are, at the present time, of pressing importance, with a view to the grand desideratum of turning to a profitable use the noxious contents of our sewers. The great difficulty seems to lie in discovering a method of expediting the processes of combination.*

In many of the red marl districts, from Devonshire to Durham, through the entire centre of England, it is the practice to lay quick-lime in long heaps parallel to the hedges of fields under preparation for wheat, and to mix lime with the vegetables, rubbish, and rough soil, from the ditch and foreland margin of the field; these are left together many days before the compound is laid on the furrows, and ploughed into the soil before the wheat is sown. The efficacy of this manure may in part be due to the decomposition of the phosphates contained by the vegetable rubbish, and by the weeds in the soil of the field, during two or three weeks' contact with quick-lime.*

The practice of manuring with quick-lime for a crop of wheat, though not exclusively limited to the red marl districts, pervades all those parts of England in which this kind of red soil prevails; and as Dr. Lyon Playfair has found phosphate of lime in very many samples of this marl, it may exist more or less through its whole extent.

Before the introduction of lime as a manure, more than one hundred years ago, the preparation for wheat was a coat of red marl, the decomposition of which, by the winter's atmospheric action, must have set free many of its phosphoric and other ingredients. Quick-lime produces a similar effect more rapidly. By the first rain that falls upon it, lime water is formed; this lime water (by its affinity for carbonic acid) disengages from the carbonate of lime within the marl enough carbonic acid to make it dissolve further quantities of carbonate of lime, and also of phosphate of lime, from the phosphoriferous marl, in a state fit to be absorbed by the next crop of corn.

It has been stated that the quick-lime sets free carbonic acid from all the vegetable matter in the soil to which it is applied, and that this acid decomposes and renders soluble not only the phosphoric and numerous other compounds of vegetable matter present in the clods (viz., old roots and stems, and dead leaves), but also any mineral phosphoric compounds that may be present in the marl. The practice of laying marl on land under preparation for wheat, was in use a century and a half ago in Devonshire, and through the midland districts, extending thence N.E. through Worcestershire and Staffordshire, into the south of Derbyshire,

* The stronger affinity of lime for carbonic than for phosphoric acid may cause a decomposition and conversion of carbonate of lime, or of marl, or marlstone, or chalk, into phosphate of lime, by a substitution of phosphoric for carbonic acid; and a similar effect might follow, if slightly baked or sun-dried clay, or marl, or powdered chalk, be submerged in sewage. The result being (as Dr. Lyon Playfair has suggested) a kind of exchange and pseudomorphic conversion of carbonate to phosphate of lime. It is probable that by a similar process the phosphorites were formed in all the strata of the crag. But the formation of these strata occupied longer periods of time than the chemists have at their disposal, and the great desideratum to which I would call attention is the discovery of a cheap and easy method of accelerating this process. I repeat what I have before stated, that the addition of carbonic acid to sewage, and of protoxide of iron and salt, and moderate heat, may induce conditions approaching to those under which analogous compounds were formed from putrescent animal and vegetable matter in ancient deposits, both under salt and fresh water, throughout all geological time.

* The accepted explanation of the use of lime has been that it hastens the decomposition of all animal matter in the soil, and reduces it to a state soluble in water, and fit to be absorbed by the new crop. Now, as one of the essential elements of this crop is phosphorus, should any fixed phosphates be present in the soil or subsoil, they also would be decomposed, in consequence of the lime setting free carbonic acid from fragments of dead plants present in the soil; this acid (being absorbed by rain water) enables it to dissolve both carbonate and phosphate of lime from any fixed carbonate or phosphate of lime contained in the marl.

and along the valley of the Trent and Vale of York, to the mouth of the Tees. Fields on the red marl through this district are full of old deep marl-pits, that were abandoned as soon as the cessation of the use of marl followed the introduction of lime, which was found to be a more quickly acting and more efficient substitute.

ON THE DISINFECTION OF MANURES, AND ON THE USE OF THE MOTHER LIQUORS OF SALT WORKS.*

BY CHARLES CALLOUD.

THE subject of disinfected manures is one which, of late years, has occupied much of the attention of agriculturists.

The importance and value of ammonia and of the ammoniacal salts, as aliments of vegetation, rendered it necessary to seek processes for avoiding the loss of them in the matters of the pits, and was in farm dunghills exposed to the air, a loss which necessarily diminished the value of animal manure.

But of all the processes hitherto employed, none completely fulfills all the combined conditions of neutralisation of the ammoniacal vapors, and preservation of certain mineral substances, whose presence in manures is highly useful.

In a paper published last year,† in reviewing the various processes in use, I endeavored to present an accurate critique on the employment of certain disinfecting agents, as the metallic salts, of which some French Societies, with a view to speculation, have recommended a general application. A more extended study has led me now to recur to a subject so interesting and important in rural economy.

Soluble salts of lead, copper, and iron, have recently been employed; it has, also, been proposed to use, as a disinfectant, the residues of the preparation of chlorine by the sesquioxide of manganese and hydrochloric acid, then the sesquioxide of manganese, sulphuric acid, and chloride of sodium, or sesquisulphate and sesquichloride of manganese; but all these salts, in my opinion, are useful only in a sanitary point of view. They neutralise, indeed, the odors of the matters of the pits, which are very offensive during the emptying, and which, moreover, are very injurious to wrought metals, from their sulphuretted emanations. But when these matters, thus disinfected, are intended for use as manure, it may be asked if the precipitates formed by the neutralisation of the hydrosulphates, and of the carbonate of ammonia, are not calculated to exert a pernicious influence during vegetation. Without possessing any absolute proofs of the poisoning of plants by the metallic salts, it is known that when they are watered with these kinds of saline solutions, they do not thrive. The metallic precipitates which remain in the disinfected matters (sulphuret and carbonate) present chances of solubility. Acetic acid is always contained in the sap of vegetables; moreover, M. Becquerel has shown that it is formed during germination. By means of this acid, the metallic carbonates are dissolved, and acetate of lead, copper, iron, manganese, &c., are formed. Such solutions, which are poisonous, absorbed by the aspiring pores of the radicles of the plants, may have injurious effects.

The presence of metallic oxides in plants is not a doubtful gas; the vegetable ashes always contain oxides of iron and manganese, sometimes of copper, and more rarely of lead. Copper is contained in some leguminous forages, especially in the *trifolium pratense*. However, it is not ascertained that the presence of these different oxides in plants is physiologically necessary for the perfect development of the organs; we can see in this only a purely accidental fact, owing to certain conditions of soils; for vegetables have perfectly prospered on soils in which copper, lead, manganese, and iron, have not existed. By the same way of solution, by the same mode of introduction, the mineral substances, like lime and magnesia, enter into plants, the metallic oxides are carried into them, and probably they would be carried on in greater quantity, if, on one hand, the power of the solvents (carbonic and acetic acids) were not exerted electively on the earthy bases, and on the other, if the law of double decompositions did not annul the metallic solutions in presence of earthy salts, which would be dissolved, as the alkaline phosphates and silicates.

These are to be taken only as purely speculative inductions, the object of which is to cause us to accept, only with reserve, the introduction of metallic matters into manures, since they may be injurious in cultivated lands.

But a consideration of importance, as regards the diminution of the power of matters intended for use as manure, makes me reject the employment of disinfecting metallic salts. It rests on this chemical reason, that the alkaline phosphates contained in the

* *Journal de Pharmacie*, January, 1850.

† *Courrier des Alpes*, No. 119, August, 1848.

urine and excrementitious matters, converted, by the addition of salts of iron, lead, copper, manganese, &c., into insoluble phosphates, become, from that time, lost or useless. Indeed, the metallic phosphates are remarkably insoluble. It is known that the strong acids attack them with difficulty, and carbonic and acetic acids, which are regarded as the principal solvents of mineral matters used during vegetation, which readily dissolved the calcareous and magnesian phosphates, have no action on the metallic phosphates. This is so true that, in analyses, when it is required to completely separate phosphoric acid from a liquid, a metallic solution is always resorted to.

M. Schulze* has pointed out the persalts of iron as an excellent means of estimating phosphoric acid in a quantitative analysis of soils. Now that it is certain that the part taken by phosphoric acid in the nutrition of vegetables ranks side by side with that of the compounds of ammonia and carbon, we cannot rationally employ the above mentioned metallic salts, as disinfectors of animal manures, under the special pretext of retaining the ammonia.

It is certain, therefore, that the alkaline phosphates contained in the liquids of the pits are rendered useless by the employment of metallic solutions. I have repeated experiments, which leave no doubt as to the correctness of this assertion; I notice this fact, for the benefit of agriculture, to stop the use of metallic disinfectants, which certain commercial companies, by means of patents, represent as approved, and as, in every respect, unobjectionable.

Sulphuric and hydrochloric acids, poured on the matters of the pits, cannot be regarded as disinfectants, since they develope sulphuretted vapors of insupportable odor; in an economical and agricultural point of view, they present real advantage. By their employment the ammonia is perfectly fixed, and the phosphates are preserved. If the handling of such corrosive liquids were not attended with some danger to people not accustomed to using them, their exclusive application might with reason be recommended.

With the same view, plaster (sulphate of lime) is employed, which can be obtained at very small expense. Unfortunately, in this case, the calcareous sulphate being very sparingly soluble, the double decomposition on which we rely in this operation is only very incompletely effected, and the result is imperfect. A soluble calcareous salt, such as chloride of calcium, would present, on the contrary, good neutralising properties; but commerce does not possess large quantities of it. This salt would, however, be easy to procure, and its price would correspond with that of hydrochloric acid.

In this review, we see that the various agents employed, either for disinfecting, or for fixing ammonia in manures, estimated at their just value, do not satisfactorily fulfil all desirable conditions. Those which would be recommended as efficacious, in an agricultural point of view, would be objectionable as regards public health; and the most desirable of them would be too expensive, and, consequently, could not be adopted by an agriculturist seeking profit. Be this as it may, it must be acknowledged that the loss of ammonia in matters exposed to the air is great, and that it is extremely advantageous to endeavor to avoid this loss by fixing in the manures an agent so important to vegetation. I should be understood, as I desire, if the consideration above laid down on the value of such or such a process of disinfection were to cause the abandonment of the question. To arrive at a simple and inexpensive process, which, in limiting the volatilisation of ammonia from urine and excrementitious matters, would have, moreover, the advantage of introducing into it fertilising substances, would be indisputably useful in an agricultural point of view. It must not be lost sight of that the saline substances contained in the matters of the pits, particularly the *phosphates*, have a decided fertilising action, and that it is important to retain them in a state which renders them susceptible of solution in the humid earth, to be thus turned to account, during vegetation, by the plants in cultivation. It is this that should determine the solution of the disinfecting agents best adapted for fulfilling these two important conditions:—fixation of the ammoniacal gases which it is necessary to retain in animal manures to maintain their value, and preservation of the phosphates unimpaired.

Several chemists have already endeavored to find advantageous means of using in agricultural economy the ammonia and phosphates of urine. I must here dwell on the employment of magnesia salts proposed by M. Boussingault, a distinguished chemist, to whom agriculture is indebted for important applications. His idea is to employ chloride of magnesium, which, thrown into the urine, produces a deposit of ammoniaco-magnesian phosphate, owing to the gradual decomposition of the urea into carbonate of ammonia. Consequently, the greater part of the ammonia rendered volatile by the putrefaction of the urine is retained, and the phosphates are preserved in all their agricultural value. It is known that the double

* *Journal de Pharmacie*, 1842.

phosphate of magnesia and ammonia is found ready formed in the seeds of gramina, and that it is indispensable to the perfect elaboration of the grain, the introduction of this double salt into manures can, therefore, only be of the greatest utility in the cultivation of cereals.

M. Boussingault's object was to bring to the dry state—accumulating most of the fertilising principles—the fixed matter of the urine of the public urinals in order thus to facilitate conveyance. It is well known that an enormous quantity of urine is lost in large towns, and that it is the richest manure; for urine, especially human urine, includes in its chemical composition the most fertilising substances of animal manures, phosphoric acid and nitrogen, under the form of acid phosphate of soda, potassa and ammonia, uric acid and urea. By putrefaction, almost all the urea disappears in the form of volatile product, carbonate of ammonia, and this is a great loss of nitrogenous matter. Every one who knows how to appreciate the combined value of ammonia and the phosphates as manures, as the substantial food of vegetables, must regret the loss of so much of useful principles. It is easy to conceive that urine, being derived from the consumption of products of the land, are, *ipso facto*, the property of the land, and that they ought not to be continually wasted.

The employment of soluble magnesian salts, as agents for fixing the volatile nitrogeneous principle which is disengaged during the putrefaction of urine, presents an advantage, because these salts form with the greater part of the ammonia of the urea, an eminently fertilising double salt, ammoniaco-magnesian phosphate, whose very sparing solubility is accurately adapted to the wants of vegetation; moreover, it is a physiological constituent of the vegetables whose fruits constitute the bases of the food of man; and it probably also exists ready formed in the feculent and caseous perisperm of the fruits of leguminæ and amygdalæ.

It is easy to explain the formation, in the earth, of the ammoniaco-magnesium phosphates used in vegetation; all soils contain a certain quantity of mineral remains of animals of all kinds, who have perished in it, and the osseous remains of these animals are very rich in phosphate; phosphate of magnesia is found in them with phosphate of lime; the carbonate disengaged by the putrefaction of every organic matter, and that which rain water brings to the earth, reacts on the earthy phosphates, and displaces lime and magnesia in equivalent quantity; it would, therefore, be a chemical action, which would furnish the natural provision of double phosphates of ammonia and magnesia, and lime contained in soils. It is to be considered that this formation can be affected only inasmuch as the earthy phosphates are disaggregated and pulverulent, owing to a decomposition of the osseous organs under the simultaneous influence of air and moisture, which, owing to the slowness of this spontaneous decomposition, must limit the production of ammoniaco, calcareous and magnesian phosphates. This observation, therefore, induces us to introduce into cultivated lands all that can be collected of those double phosphates, artificially prepared.

M. Bouchardat's investigations, concerning the action of ammoniacal salts or vegetation, have confirmed him in the opinion that no other than the carbonate is favorable to plants; however, M. Schattenmann extols the advantages of sulphate and muriate of ammonia employed in irrigation on meadows; this plan, according to this learned agriculturist, produces a luxuriant vegetation; he also praises a process followed in Switzerland, which consists in saturating the water of the pits and dunghills with sulphate of iron, by means of which the ammoniacal salts are fixed, and in spreading them on the meadows. His own experiments have proved to him the efficacy of ammoniacal salts fixed in manures, in the state of either sulphate or chloride.

How can the opinion expressed by M. Bouchardat, which also rests on practical experiments, be reconciled with these facts? We should be led to believe that the experiments were not made in identical conditions, or that the different constitutions of the soil, according to M. Boussingault's observation, have something to do with the difference of opinion of these two observers. Since carbonate of ammonia alone is profitable to vegetation, in order to admit a correlation with the efficacy, acknowledged by several experimenters in other salts of ammonia; these, by some reaction, cannot be brought to the state of carbonate; this is the explanation given by MM. Boussingault and Barral.

Without forgetting, on the other hand, that ammonia rendered moveable, under the influence of vegetation submitted to the vital forces, undergoes so many organic metamorphoses, it is to be remarked that, in the analyses of vegetables, it is not found in the state of sulphate, nitrate, or hydrochlorate, but it is found in the state of *phosphate, united with lime and magnesia.* Would not this observation appear to show this in the state of ammoniaco-calcareous, or magnesian phosphate, the employment

of ammonia is most profitable to vegetation; that in the state of neutral salt, the ammonia is not assimilated in the vegetable economy without decomposition, and that, associated with a mineral base, it is apt, on the contrary, to assimilate physiologically in the organic molecules. The invariable presence of phosphoric acid, of the alkalies of lime, and of magnesia, in albuminous substances, very rich in nitrogen, as albumen, caseum, and gluten, would tend to give this opinion some character of truth. The association of *fixed* mineral matter with *mobile* organic matter is then a vital condition in the nutrition of vegetables.

If it has been observed that ammonia, employed separately, has produced vegetations of magnificent appearance, that may be attributed to an influence of regimen which, as in animal physiology, causes swellings, a tumefaction of the tissues which does not constitute a normal state of vitality. It has been observed that the employment of ammonia, as a special manure has proved its efficacy indubitably; thus, in watering a meadow, in the form of certain letters, it was perceived, after some time, that the places watered were distinguishable by the greenness of their leaves, and by a very different vigor of vegetation; but this is only a proof of the fact, and not of principles. The plants which prospered so well under the sole influence of this ammoniacal agent, acquired, perhaps, a peculiar beauty, but they were deprived of rigidity and consistency—they bent and fell down under their weight, and had not the character of fine natural vegetation. I know well that in agriculture it is quantity of product that is sought, and that this must be the constant object of the agriculturist; but until we have demonstrated that the products superinduced by art are equal in quality to natural products—until careful experiments have proved that the hay obtained from meadows which have undergone special ammoniacal irrigations has been much more profitable in fattening cattle—the various applications proposed for manure must be received only with judicious circumspection. All these considerations, flowing rather from observation than from scientific data, prove, moreover, that the question of disinfected manures is far from being exhausted, and that it still requires much research and investigation.

In taking account of the combined utility, as manure, of ammoniacal salts and phosphates, it is certainly more rational to employ, especially as disinfectants, salts capable of preserving all the fertilising substances contained in the liquids of the pits and dunghills. The soluble salts of lime and magnesia are beneficially applicable to this purpose. I have made experiments which have proved the neutralising action of the salts of magnesia on the urine. Excrementitious matters which contain, also, sulphuret of ammonia on which calcareous and mangnesian salts have very little action, cannot be disinfected by the employment of those earthy salts; but by adding a certain quantity of charcoal in powder, all odor is immediately destroyed. I have thus preserved for a month some of these matters in a room, with the aid of sulphate of magnesia and charcoal, without having been annoyed by it. We are well acquainted with the disinfecting action of charcoal, owing to its porosity and its property of condensing gases; through this condensation interesting reactions occur, which have been very little studied. Gases brought into contact, in a state which considerably reduces their volume, unite intimately when they are susceptible of forming direct combination between themselves, consequently deleterious gases are neutralised.

On the other hand, sulphuret of ammonia undergoes in the air, as when it is retained in the pores of charcoal, a decomposition peculiar to the alkaline sulphurets, that is to say, the atmospheric oxygen gradually burns its sulphur and ammonium, converting the latter compound into hyposulphite, and then into sulphate of ammonia, both of which salts are odorless, and fixed at the ordinary temperature, which certainly lessens the loss of the sulphuret of ammonia contained in excrementitious matters.

From the experiments which I have made, and the foregoing considerations, I think that the disinfecting process, resulting from the employment of magnesian salts and charcoal, would be recommendable for fixing the ammonia in matters intended for manuring. It remains to be determined whether the manure thus disinfected would be superior in agriculture, and I recommend this to be done by agriculturists experienced in trials of this kind.

It is certain that the price of magnesian salts would be an obstacle; but if we take into consideration the value of ammonia and the phosphates, and the loss occasioned by exposure to the air, the expenses occasioned by their employment will be regarded as insignificant. But we can procure calcareous and magnesian salts, for use as disinfectants, at small expense, and in small quantity; for that purpose it would only be necessary to turn to account the residues of saline springs and salt marshes, known by the name of mother liquors, which are very rich in chlorides of magnesium and calcium.

In the localities where table salt is prepared, it would be easy to turn these mother

liquors to direct account. In distant localities, the inconvenience of the mode of conveyance would restrict its employment; but this difficulty would be obviated by bringing to the dry state the useful salts contained in them; by this means conveyance would become much more economical and practicable. In Savoy we have some considerable salt springs; the mother liquors, as is known, being useless, are thrown away, owing to their agricultural value and utility, every intelligent man must regret their loss.

While on the subject of the turning to account the mother liquors of salt springs, I may call attention to a most important application of which they are susceptible; a French chemist has, within the last few years, proposed the employment of chloride of calcium dissolved in water for extinguishing fire; experiments made by order of government have proved the advantages of the system proposed by this chemist. Many mineral substances possess the property of arresting the intensity of the fire; stuff impregnated with salts of lead and alumina are rendered incombustible. Fuch's soluble glass, and the basic silicates of soda and potassa for impregnating the rigging of ships, such as the sails and cordage, in order to secure them from fire. I think that the mother liquors of salt springs and salt marshes might also be used. Chloride of magnesium is an eminently deliquescent salt, and retains water with much force; doubtless it is endowed with the property possessed by chloride of calcium for extinguishing fires.

M. Boucherie, in his memoir on the preservation of wood, showed that wood impregnated with chloride of iron, resisted the fire which had completely destroyed, in a comparative experiment, pieces of ordinary wood. Thus the mother liquors of salt springs which are very rich in chloride of iron are applicable to the extinction of fire; here, the same inconvenience exists as regards carriage, and may also be remedied by desiccation. In localities near the place of working, the mother liquors might be employed in their natural state, for guarding against the danger of fire. In large public establishments, such as manufactories, hospitals, theatres, colleges, &c., where danger of fire is most to be feared, it would be a good precaution always to have provided a certain quantity of these mother liquors.

ON THE MUD OF THE NILE.*

ANALYSIS MADE IN M. PAYEN'S LABORATORY AT THE NATIONAL CONSERVATORY OF ARTS AND TRADES.

First Analysis, by M. Lajonchère, of a Sample obtained from M. D'Arcet, jun.—This sample occurred in irregular pieces easily reduceable to a fine powder, soapy to the touch, with shining grains.

It slightly bites the tongue, and possesses a perceptibly bitter, saline taste; its density is 2·5, being nearly equal to that of some fertile lands.

Calcined in the air, it assumes a brown red color, loses in weight by the evaporation of water, and by the burning of organic matter.

Calcined in close vessels, it gave vapors, which were shown to be alkaline by litmus paper.

An analysis, made by employing 1·638 grs. of normal mud, representing 1·541 of dry mud, furnished 3 cubic centimetres of gas measured at 66° F., and at the pressure of 0·7565, which corresponds to 3·43 mil. of nitrogen in 1·638 of normal matter, or 2·22 per 1,000 of dried matter.

The normal matter, therefore, contains 2·10 of nitrogen per 1,000.

These numbers make the mud of the Nile approximate to very fertile lands.†

A careful incineration of the matter dried at 220° F. in vacuo, for five hours, indicated 4·75 of organic matter per cent., or 47·5 per 1,000. This nitrogenous organic matter contains, therefore, 4·67 of nitrogen per cent.

The matter soluble in water was extracted in order to estimate the nitrogen which it contained. The following are the results of this second analysis:—

Treated at 212° F., in a sand-bath, 100 grammes of mud gave a solution which, filtered and evaporated in a water-bath, left a residue weighing 0·866 gr., and containing 23 per cent. of its weight of organic substance (after careful incineration).

0·237 of dry matter, analysed by combustion with oxide of copper, furnished a volume of gas equal to 5 cubic centimetres, under the pressure of 0·7608 and at 66° F., which corresponds to 0·00573 grs. of nitrogen, or to 0·019 grs., per 0·866 grs., of soluble substance contained in 100 grs. of dried mud.

Thus, the matter of this second analysis

* *Journal de Pharmacie*, Jan., 1850.

† The following are the results of the determination of nitrogen of normal soils made by M. Payen:—

1,000 parts in the drystate.	Soil of Boulbème (Haute Garonne)	0·7	not very fertile.
	Soil of Courneuve, near Paris	2·2	very fertile.
	Soil of Limagne	3·2	
	Soil of Russia, brown	1·65	

contains 2·19 per cent. of nitrogen, and the organic matter contained in 1,000 of dry mud represents 1·7 of nitrogen.

Finally, it may be concluded from this experiment, that the organic matter of the mud of Egypt represents the whole of the organic matter contained in this mud.

MINERAL ANALYSIS.

Portion soluble in water ..	Silica	0·05
	Water	4·75
	Organic matter.....	4·84
	Alkaline chlorides....	0·65
Portion soluble in hydrochloric acid	Peroxide of iron	11·90
	Alumina	21·65
	Carbonate of lime ..	3·85
	,, of magnesia	2·05
Matters insoluble in water and acid.	Silica	46·55
	Alumina.....	3·70
		100·00

Second Analysis of the mud of the Nile, by M.M. Payen and Poinsot.—The sample was furnished by M.M. Brongniart and Decaisne.

This sample was under the form of a fine powder containing yellow bractese of mica; mixed with water, it absorbed a certain quantity of it, and forms a somewhat plastic paste.

Calcined in a close vessel, it directly gives alkaline vapors; calcined in the air, it leaves a reddish residue.

The following is its composition in 100 parts:—

Water	3·25
Organic matters soluble in water....	0·35
" " insoluble in water..	4·46
Alkaline chlorides.....	0·07
Sulphate of lime	0·37
Carbonate of lime.....	6·33
Magnesia and carbonate of magnesia	4·09
Silica	54·27
Alumina	10·77
Peroxide of iron	13·18
Lime.....	2·86
	100·00

It is very remarkable that the mud of the Nile does not contain any traces of phosphate. Regnault in 1812, and M. Lassaigne in 1844, did not find any.

ANALYSIS OF THE MOLASSES OF BEET-ROOT SUGAR EMPLOYED IN FEEDING BEASTS.*

BY MM. PAYEN, POINSOT, AND BRUNET.

100 of normal molasses contain:—

Water.. 21·74 (in vacuo, at the temperature of 300° F.

Ashes .. 12·58

Nitrogen 1·47

100 of dried molasses therefore contain—

Ashes .. 16·07

Nitrogen 1·89

Composition of the ashes—

Carbonate of potassa ..... } Carbonate of soda ..... }	77·10
Chlorides of potasium and sodium ..	12·54
Sulphate of potassa	2·23
Carbonate of lime	6·95
Carbonate of magnesia	0·94
Alumina and traces of oxide of iron	0·17
Silica.....	0·07
	100·00

The organic matter, deprived of water and ashes, would contain 2·25 per cent. of nitrogen.

* *Journal de Pharmacie*, January, 1850.

ON THE ALLOYS OF GOLD AND SILVER USED IN THE MANUFACTURE OF JEWELLERY, PLATE, &c., WITH AN EXPOSITION OF THE VARIOUS FRAUDS PRACTISED THEREIN.

BY WILLIAM GRIFFITHS, WORKING GOLDSMITH.

LETTER II.

To the Editors of the Chemist.

DEAR SIRS—In my last letter I gave the method of "coloring" the work made of the 22-carat alloy, and the mixing of the metals to form that alloy. As the chemical cause of the effects produced in those processes appears to be the same in all alloys of gold, I will now explain my views on the subject. I have long been of opinion that, when gold, silver, and copper, or other metals, are mixed together by fusion, *they do not chemically combine or dissolve one into the other*, but that the particles of each metal are displaced and diffused as the heat applied acts upon them, in proportion to their fusibility. Fine gold fuses at a lower temperature than silver, and silver at a less degree of heat than copper; therefore, in combining the silver and copper in particles in the alloying process, *first*, I am certain of the particles of each being thoroughly disseminated, and when the gold is added, as before described, the easy fusibility of the copper and silver* alloy acts at once upon the surface of the gold and materially assists the operation.

When silver and copper are fused together, it appears to me that the former operates as a kind of solder on the particles of copper

* When copper and silver are united by fusion, the alloy fuses at a lower temperature than will either metal separately.

displaced at their fusing point; then, when united, of course the particles of copper (this metal being lighter than silver) are larger; the copper is the mass, the silver the connecting medium. Again, when the gold is added (its particles being still more minute), and when dispersed by fusion, the entire mass becomes an infinite mechanical mixture of particles of gold, silver, and copper. In proof of this opinion, I beg to offer the following facts:—

If equal quantities of gold, silver, and copper are melted together and *allowed to cool*, gradually, in the bottom of the crucible in which they were melted, on applying nitric acid to the upper surface of the button, chemical action is at once evident, and the usual green nitrate of copper appears; the same test applied to the lower surface of the button presents *no* chemical action. It appears to me, therefore, that owing to the particles of gold being heavier than those of the silver and copper, they have a natural inclination *downward*, and fall through, as it were, during the slow cooling of the metals, and that, to a certain extent, they were previously kept in a state of agitation during fusion, which would not be the case had a *chemical* and not a mechanical union taken place. If, instead of allowing the button to cool slowly, as above described, the fused mass be poured quickly into an iron mould, or otherwise rapidly cooled, the nitric acid produces scarcely any effect on any part of the mass, as the suddenness of the cooling prevents the uneven deposition of the gold in the manner alluded to. Another proof of my opinion is that, if any alloy of gold, silver, and copper, under 14 carat, and above 8 carat, be well rubbed on a touchstone or piece of smooth slate, until the surface of stone or slate appears *gilt*, on applying a drop of nitric acid to the gilt surface of the stone the copper is first attacked, owing to its affinity for nitric acid, and the globule assumes a green color. Soon after, the remaining free acid attacks the silver, the nitrate of silver formed remains beneath the nitrate of copper, and, on allowing the globule of acid to evaporate spontaneously, three distinct layers remain on the stone, the uppermost is nitrate of copper of the characteristic green color; the next layer, oxide of silver*, and the layer nearest the stone is gold in the usual brown powder. This result is very satisfactory, as, if the piece of solid alloy, which was rubbed on the stone, be tested with cold nitric acid, no chemical action takes place on its surface (presuming its quality to be above 8 carats), so that it is owing to the distribution of the particles of metal on the stone, which renders them pervious to the nitric acid, in proportion as their affinity for it prevails. This is an interesting fact, which I hope will be further investigated and developed by scientific men.

As regards the size of the particles of the metals, the only judgment I can exercise is the examination of their fracture; for, when broken, I observe that the heavier the metal used, the smaller its particle and its greater capability of spreading when mixed with other and inferior metals.

With respect to the coloring process used for the 22 carat alloy, of which I gave the formula in Letter I., I wish merely to publish my own views concerning the ultimate colored being made red hot and allowed to cool in the atmosphere it becomes oxidised on the outer surface, and is of a brown color; the next object to be attained is to remove that oxide, and leave the surface of a pure gold color. When the salts before mentioned are united and mixed with as much water as will thoroughly dissolve them, and a boiling heat applied, there can be very little doubt that the greater portion of the nitric acid contained in the nitrate of potassa is set free in the form of nitrous vapours, and that the chlorine is also evolved from the chloride of sodium; if such were not the case the nitro-hydrochloric acid formed by the two above salts would at once dissolve the gold, and as the potassio-sulphate of alumina (alum) result, and the reason of it. The article to be contains about 33 per cent. of sulphuric acid, which is not volatile like the other acids that it combines with the salts, and forms double combinations of sulphate of potassa and sulphate of soda.

The fact of the sulphuric acid being the great agent, I have sufficiently proved, by substituting sulphuric acid for the alum in the process, and found that it answered the purpose better for the lower alloys of gold, as the salts thus combined act much quicker on the surface, and do not penetrate so deeply or rot the work so much, still the formula with the alum is better for the higher alloys, being slower in action. The slight amount of nitro-muriatic acid remaining in the solution after the evolution of gases, is also of service, as it eats away a small portion of the gold and leaves the surface "dead," or "matted," as it is termed, which is the appearance required in some cases; but when the sulphuric acid is used, and a low alloy (say 16 carats) is to be colored, the evolution of the gases is so much more rapid, as

* As the globule of nitric acid requires a considerable time to evaporate, the nitrate of silver becomes oxidised by absorption of oxygen from the atmosphere.

also the action of the salts, that the work is much brighter. The chemical cause of the result obtained appears to me to be thus: That the brown oxide on the surface (after the heating and absorption of oxygen during cooling) is an oxide of copper, which sulphuric acid and water remove at once; then the article is much whiter on its dead surface than even the natural color of the metal. Of course these are the pellicles of silver and gold. We have to remove the silver next, which is not so easily done. As we wish to penetrate some little depth, we use the saline solution for this purpose. The sulphates of the salts combine with the oxides of the metals when placed in the solution forming a sulphate of the oxide of silver, and a sulphate of the oxide of copper, which are taken up by the salts, leaving only the fine gold visible on the surface. I have no doubt that the oxygen of the nitric acid contained in the nitrate of potassa, contributes also to the formation of oxide, which the sulphates remove. I give the formula I adopt for colouring with sulphuric acid instead of alum:—.

	oz.	dwt.
Nitrate of potassa.....	8	0
Chloride of sodium	4	0
Water	2	0
Sulphuric acid.....	1	0

This process of coloring is performed as follows:—It is called "wet coloring" as there is a process called "dry coloring" which I will give with the quality for which it is used; the salts are first weighed, then mixed with the water put into a crucible of sufficient size to prevent boiling over, then heat is applied until the entire of the salts are dissolved, the sulphuric acid is poured in and allowed to boil a minute or two to permit the gases to exhale. The work to be operated on, is put into the solution and allowed to remain about four minutes, it is then taken out and rinsed into boiling water, then placed in the solution for two minutes and is by that time generally fit for finishing, by closing the unconnected particles of gold on the surface by burnishing the parts requiring to be bright, as the fine gold is soft and the mass beneath much harder, the pressure of the burnisher extends the particles of fine gold* which take their brightness from the surface with which they come in contact.

These observations go still further to convince me that I am right as regards the fact of particles of the metals *mechanically combining*, and I would not now urge my views of the matter on your notice, but that I have so often heard it disputed, and that by persons whose scientific standing should have made them more careful as to how they risked their reputation by asserting a position decidedly opposed to common sense and the knowledge of the practical man.

In your last No., I had proceeded as far as the 22 carat alloy, the next is the 20 carat. The compound of the metals is as follows.

	oz.	dwt.	grs.
Gold	0	16	16
Silver	0	1	12
Copper	0	1	20
	1	0	0

This alloy is used for the better kind of cast jewellery, where stones of a soft or fragile nature are to be set (such as emeralds, opals, turquoises, &c.), as the alloy thus formed is particularly soft and ductile and easily pressed over the edges of the stones. If I may infringe so far on your journal as to detail a "mechanical" operation, I will state how the casting of the article is performed.

A pattern of wood, lead, or other metal is made, precisely the same as the article required. A quantity of sand of the finest description is then rubbed up with a sufficient quantity of beer to render the sand adhesive. One half of a flask* is then laid on a board, and the pattern placed on the board in the centre of the flask; finely-powdered charcoal is then shaken on the pattern and the board, to prevent the sand adhering; the sand is then shaken on the pattern until it forms a cone. A heavy piece of wood is used to hammer or compress the sand till it becomes quite hard; the flask is then removed from the board, which has formed a flat surface of sand in which the pattern is buried. The sand is then removed or scraped away to the depth of half the pattern, which is then relieved, and will fall out of the sand on being gently tapped, which will also remove any superfluous sand which would have held the pattern in the mould. The pattern is then replaced in the impression, and charcoal dust again shaken on the surface, to prevent the fresh sand adhering; the second half of the flask is then put to the first, and sand again shaken on, again hammered till quite hard; then the flask is separated, the pattern removed, a channel for the

* I consider that the particles of copper and silver next the surface, have become oxidised and removed by the action of the salts, and I know that if the process of coloring is continued too long, the gold only is left behind in a spongy state.

* A flask consists of two square rims of cast iron, made to fit together with pegs, so that they may open and close exactly, and with an aperture at the top, and called the gate, to pour in the fused metal.

metal is then cut to the gate, and small vents or scratches are made to permit the expulsion of air when the fused metal is poured in. The sand in the flask is then dried or baked, and the surfaces smoked over an oil or gas flame; then put together in a wooden clam or vice made for the purpose, and the alloyed gold, previously fused to a white heat, poured in at the gate, taking care that a sufficient amount of metal is used not only to cast the article, but so much that, by its superabundant weight, it will drive down the metal to the very bottom of the mould. The cast is then perfect as the pattern, and very little trouble will render the cast copy fit for use. This method merely applies to solid articles, which are not made so often as they are professed to be. The various systems of making hollow work, and filling with silver, with solder, and other processes, which I will detail in due course, renders the problem of getting a piece of really solid jewellery one very difficult of solution, except to the practised eye of a workman. The solder used for 20-carat gold is thus :—

	dwt.	grs.
Gold 20 carats.....	1	0
Silver	0	3
Copper.....	0	2
	1	5

The process for coloring this alloy is in all respects the same as for the 22-carat alloy, with this difference, that being lower in quality it colors somewhat easier and quicker, as the lower the quality, down to 14 carats, the more effect the salts have on the surface.

I shall now proceed with the next and more important alloy, more important as it is the one used for the manufacture of watch-cases, mourning-rings, and is the alloy for what is called dry colored work. It is the new standard gold, and the lowest alloy marked by the Hall. Its number is 18 carats, and it contains three-fourths gold and one-fourth alloy, the formula for which is as follows :—when for bright finished or polished work the silver is in excess—when for colored work the copper is the largest quantity—I give the bright alloy :—

	oz.	dwt.	grs.
Gold (fine).....	0	15	0
Silver.....	0	3	0
Copper	0	2	0
	1	0	0

This alloy is melted as before described—the silver and copper first, the gold added when the other metals are fused. One of my reasons for this method is, that, perchance, if all the metals are put in the crucible at the one time, the copper and silver might not be thoroughly disseminated, owing to the copper being harder to fuse than the other metals—it might become covered with them without being disseminated, which would be fatal to the alloy. Another reason is, that should the crucible not be good (which is frequently the case) the copper and silver require greater heat than the gold, so that its soundness is well tested before the gold is put in, and that should it break when the silver and copper only were in it, the loss would be trifling.

When the compound is well melted, and of a greenish transparent hue, it is poured, as before described, into an iron ingot, and is ready for working, it can be wrought or cast as the other alloys, and is very soft and ductile. The solder used is as follows :—

	dwt.	gr.
Gold 18 carats	1	0
Silver	0	3
Copper	0	2
	1	5

When filagree or very light work or chains are made of this alloy, I use the following formula for solder :—

	dwt.	gr.
Gold 18 carats	1	0
Silver	0	4
Brass	0	2
	1	6

The solder is applied as in the other alloys, using borax as the flux, and placing the palliene, or small piece of solder immediately on the juncture, when, with a heat just below fusing the gold itself, the solder rushes into the interstice and renders the joining perfect. In the art of soldering gold much skill is required, such as by a careful manipulation of the blowpipe, keeping the entire article to be soldered at an equal heat, and suddenly darting a pointed blast on the spot where the solder is placed, the junction of the metals must be quite clean and well tied together. The borax is of more real service to the process than would be supposed, as it not only prevents the surfaces to be joined from being oxidised, but it also protects the solder from the same defect which would render the soldering bad and brittle. This alloy is sometimes Hall-marked, and in the case of watch cases and mourning rings, it is compulsory that they should be so, but as the duty on jewellery is heavy (17s. per ounce), dishonest manufacturers avail themselves largely of their opportunities to evade it, and as the assay masters are seldom workmen, the deceit remains undetected. One of the most frequently practised frauds is to send to the Hall to be marked a narrow plate of gold, much

thicker than is required for its "real" purpose, its ostensible use being for what is called a "widow's hoop," when it is returned from the Hall ("marked"), it is hammered out thin, and a heavy outside put to it, often of "inferior gold." Another is to send a "lining," as it is called, of a mourning ring, and sending two very light wires with it as though for edges; then, when returned, the lining is used, perhaps, for a very heavy ring, and the edges sent are not used at all, but melted. But the most dangerous of all methods of evading the Hall, as it is called, is getting one ring of a dozen marked in the straight—that is, opened out; then with a fine facing of rottenstone dust casting off the remaining number of an inferior alloy (of course the mark is cast at the same time), but who is it that is cheated by this system of trickery? The public, of course; but how?

In the first place, the shopkeeper, or retailer of articles of jewellery, &c., is seldom or never a workman. Why? How could it be expected that an individual trained in a workshop, should be expert in all the flattery and falsehood necessary to be a good shopkeeper; lying and imposition being the requisites and necessary accomplishments for that now important branch of non-producing effrontery called shopkeeping; thus it is that the retailer* is imposed upon by the manufacturer, he again imposes on the public—let us hope not wilfully, but by mere ignorance of the business he professes—still the excuse does not palliate the crime. To return to the Goldsmith's Hall, who are the assay masters? In one of the halls at present a carpenter presides. Not a chemist. Oh, no! Such a one once did attempt such an honor (qy?), he was outvoted by the shopkeepers. Why? He lost that, but he gained instead knighthood, and the professorship of a college. He was, and is, one of the lights of the science; and his surveillance was dreaded. He knew too much!!!

I have now, perhaps, gone into matters which are not altogether suited to the pages of a journal so highly and purely scientific as yours; but I know that your readers will excuse the trespass, as they are all, more or less, concerned in the subjects I have mentioned; and, as it requires a chemical knowledge to detect the various and deep-laid schemes I have and shall treat of, perhaps, the little good I may do (in unravelling and attempting to cure the numerous ills the "trade" is heir to, and the world the victim of) may compensate your readers for the trouble they may take in the perusal of these papers.

I have been led to make the above remarks, in order that chemists who, from their knowledge of the precious metals, &c., and the public in general may be put upon their guard, and protect themselves as much as possible, by exercising their own judgment, by testing the materiel, the means of which I will place in their hands, in a future number of THE CHEMIST; and in treating of the lower alloys of gold, I will show how the appearance is maintained where the material is not. In the meantime, I beg to recommend to those persons who are interested in what I have already penned not to be beguiled by the empty words of mere retailers, but to wait and read, and they shall be instructed.

I remain, dear Sirs, truly yours,

WILLIAM GRIFFITHS,

February 19th, 1850.

* In this city where I now reside there is not a shopkeeper who is a workman in the jewellery business—and it is the same throughout the United Kingdom. I know of *two workmen* in Scotland who keep sale-shops.

ABSTRACTS OF SPECIFICATIONS OF CHEMICAL PATENTS RECENTLY ENROLLED.*

Improvements in the Preparation of Materials for coating Ships and other Vessels. ADAM YULE and JOHN CHANTER. Sealed Aug. 1, 1849.

THE object of this invention is to protect ships' bottoms, whether plain or sheathed, from marine deposits, by coating them with one or other of the following compositions:—

1. 8 to 10 parts of bullock's gall, 30lbs. of carbonate of iron, or plumbago, reduced to a fine powder, mixed together to form a paste, to which 4 gallons of salt water are added to bring the whole to the proper consistency. [What relation is there between parts and pounds?]

2. 30lbs. of carbonate of iron or plumbago in powder, 3lbs. of white arsenic, 2½ gallons of coal tar, naphtha, or spirits of turpentine, and from 12 to 14lbs. of Stockholm tar dissolved in the above spirit.

[NOTE.—In the case of iron or zinc, it is to be first coated with a solution of caoutchouc or gutta percha, before laying on either of the above compositions.]

3. No claims are made in this specification.

* *Collected from the Mechanics' Magazine.*

Improvements in the Manufacture of White Lead. J. E. D. Rodgers. Sealed Aug. 1, 1849.

The patentee proposes to manufacture carbonate of lead, commonly called white lead, by suspending pieces of sheet or cast lead, bent in the form of two sides of a triangle, upon frames erected in a room, or chamber, which is capable of being darkened and rendered air tight, or nearly so, when required. Underneath the frames are troughs, some of which are filled with a fluid capable of passing into the state of vinous fermentation spontaneously, or of doing so on the addition of yeast, and thereby evolving carbonic acid gas. The other troughs contain sour beer, vinegar, or other similar fluids, into which steam pipes from a boiler are caused to open, so as to produce acetic acid, or pyroligneous acid and aqueous vapors. The *modus operandi* is as follows:—The pieces of lead are suspended in the frames as close together as possible without actual contact, and the chambers made air tight, or nearly so, and maintained at a temperature of from 70° to 80° F. As soon as the carbonic acid gas is evolved, the chamber is darkened, and steam admitted about three times in every twenty-four hours, to produce acetic or pyroligneous acid and aqueous vapors. The chamber is provided with a man-hole, to allow of the troughs being replenished when the fluid contents have been exhausted, which will occur at the expiration of forty-eight hours. This operation for converting metallic lead into carbonate of lead generally takes twelve days.

Claims—1. The use of a chamber, or room in the manufacture of white lead, which is capable of being made air tight, or nearly so, when required, and into which the supply of carbonic acid gas, and acetic acid, or pyroligneous acid and aqueous vapours, may be controlled or regulated.

2. The introduction of steam into the converted chamber, either alone or combined, as described.

Improvements in Converting Sea Water into Fresh, and in Ventilating Ships and other Vessels; applicable also to the Evaporation of Liquids, and to the Concentration and Crystallisation of Syrups and Saline Solutions. James Murdoch. Sealed Aug. 1, 1849.

These "improvements" consist in the adaptation to the top of an ordinary ship's boiler, which is filled with salt water and employed to heat the contents of sauce-pans, &c., of a pipe, which descends into the hold, and opens into a vessel contained in an outer casing filled with cold water. This vessel is fitted with a number of vertical tubes in communication with the descending pipe, and all provided inside with a number of horizontal discs of wire gauze. It terminates at bottom in a zig-zag pipe, which passes through the side of the cold water cistern, and opens at top, underneath an exhausting fan. The upper part of the boiler is furnished with a perforated tube which admits atmospheric air. When the fan is set in motion, the air and steam generated in the boiler are drawn together down the vertical pipe, through the tubes and the wire gauze discs placed therein. The steam is condensed in its passage, and rendered pleasant to the taste by mingling intimately with the atmospheric air, which is exhausted by the fan and thereby discharged.

The ship may be ventilated through the agency of this fan by connecting a perforated pipe, placed underneath the middle deck, to its discharge. This pipe may also be connected to a second perforated lower pipe, placed on the lower deck, and connected to a vertical pipe which communicates with the atmosphere.

An apparatus similar to the one first described, with the exception of the condenser, the use of which is dispensed with, may be applied to the concentration and crystallisation of syrups and saline solutions. The form of the boiler being, of course, modified so as to assume the appearance of the ordinary fan; and, in some cases, the bottom is made corrugated, to form continuous zig-zag channels, through which the steam circulates for the purpose of increasing the heating surface.

Claims—1. The employment of a current of air, produced by an exhausting fan, for accelerating the evaporation of salt water.

2. The application of a current of air, produced by an exhausting fan, to the distillation of alcoholic or spirituous liquids.

3. The mode of ventilating ships, in combination with the apparatus for converting salt water into fresh.

4. The employment of apparatus for the concentration and crystallisation of syrups and saline solutions, having continuous zig-zag channels for the circulation of steam therein, closed, or not, and combined, or not, with the exhausting fan.

Improvements in obtaining Carbonated (Carburetted?) Hydrogen Gas, and in applying the products resulting therefrom to various useful purposes. F. J. De Cavaillon. Sealed Aug. 1, 1849.

The patentee observes that the ordinary carburetted hydrogen gas has hitherto been manufactured from coal alone, but that he proposes to mix with the coal, in the proportion of 50 per cent., bones, suet, oleagi-

nous seeds, spent bark, and saw-dust, which has been used in the purification of oils, or any fatty or oily waste. These substances are moistened with molasses or empyreumatic oil, and mixed with the coal, after which the whole is shovelled into ordinary gas retorts, and distilled in the ordinary way.

The resulting products are stated to be—

1. Carburetted hydrogen gas, of a high illuminating power.
2. Animal charcoal.
3. Animal and vegetable charcoal, in powder, which may be applied to the preparation of manure.
4. Empyreumatic oil.
5. Rich ammoniacal liquors.

In order to economise the lime employed in the purification of gas, it is proposed to employ a purifying powder, composed one-half of any of the natural or artificial sulphates of lime (by preference, plaster which has been used in building), animal charcoal, vegetable charcoal, coke, river or sea sand, spent bark, sawdust, peat or turf, sulphate, and oxide of lead, all reduced to powder, and wetted with dilute sulphuric acid, or acidulated water of 6° to 7° Beaumé. The gas to be purified is made to pass through perforated metal plates, or wire gauze shelves, upon which is laid moss to prevent the apertures being clogged by the refining powder which is laid thereon. The lime is laid above the powder. The quantity of lime employed is one-third, and that of the refining powder two-thirds; which last is composed of purifying substances, such as the sulphates of lime, inert substances rendered purifying, such as sawdust, saturated with sulphuric acid; and inert substances, such as powdered coke. When the materials are charged with too much ammonia or sulphuretted hydrogen (which can be ascertained by causing the gas to come in contact with turmeric test-paper, and paper saturated with acetate of lead, which will be turned black), they are to be replaced by a fresh supply of refining powder and lime.

No claims are made in this specification.

Improvements in making Roads and Ways, and in Covering the Floors of Courtways, Buildings, and other similar purposes. A communication. A. RŒHN, Paris. Sealed Aug. 1, 1849.

The object of M. Rœhn's invention is the employment of natural or artificial asphalte in a cold state; and it is proposed to be conducted by either of the following methods, according to the resources and character of the locality where the paving or covered way is to be laid down :—

I. A mastic is composed of—

	lbs.
Asphaltic rock	176
Bastenne pitch, or coal tar, or pitch of analogous consistence.....	15
Pyrogeneous oil of resin, or other fixed oil	7

Or when the asphaltic rock cannot be procured, the mastic may be prepared with—

	lbs.
Common gray or hydraulic lime	220
Refined coal tar	170
Pyrogeneous oil	7

The pitch is first melted, and the asphalte or lime added, after which the oil is poured in, and the whole is made to simmer gently until the ingredients are thoroughly incorporated. It is then cast into slabs, which, when cold, are employed for paving, in the ordinary manner, sand being added in the proportion of about 60 per cent.

II. The road is levelled, and a stratum of wet gravel, about two inches deep, is rammed down smooth over it. A layer, about four inches deep, of macadamised stones is laid upon the gravel, and then, above the stones, a second layer of asphaltic rock, broken into pieces of two inches, one inch and a half, and half an inch in size, which have been placed in an open basket, and dipped in pitch. The road is next beaten, or rolled level, to cause the pieces of asphaltic rock to bind together, and the interstices between them are filled up with an elastic mastic, which is ladled on to the road, and scraped over it, which is well understood by asphaltum layers of the present day. Being of a yielding nature, this sort of paving affords firm footing to cattle travelling upon it. The elastic mastic is composed of—

	lbs.
Bastenne pitch.....	222
Pyrogeneous oil	88
Asphaltic rock.....	686
Gravel	206

Or—

Bastenne pitch.....	88
Pyrogeneous oil	88
Any suitable calcareous substance	686
Gravel	206

Instead of the elastic mastic, it is, in some cases, proposed to employ what the patentee calls "mastic in the form of sand." It is composed of—

	lbs.
Bastenne pitch.....	25
Pyrogeneous oil	65
Asphaltic rock.....	780
Gravel	275

Or—

Bastenne pitch.....	100
Pyrogeneous oil	100
Lime.....	690
Gravel	275

III. When asphaltic rock is not easily to be procured, it is proposed to employ, in its stead, pieces of rag-stone or potters' earth, which are well dried, and afterwards steeped in a mixture of 110 lbs. Bastenne pitch and 5 lbs. pyrogeneous oil. The pieces are dusted with some calcareous substance, in powder, and the oil is subsequently allowed to drain from them, after which they are ready for use.

IV. When parts of the road are worn away, they are to be brushed over with a mixture of Bastenne pitch and pyrogeneous oil, and gravel sifted over them.

The pyrogeneous oil is employed to toughen the material, and a road constructed as above described will, it is said, be ready for traffic in forty-eight hours after it is completed.

Claims—1. The preparation of a hard and durable mastic, by the employment of bitumen, pitch, fixed oils, and calcareous substances.

2. The mode of preparing the elastic mastic.

3. The preparation of artificial asphaltic rock.

4. The preparation and use, in a cold state, of mastic, or natural or artificial asphaltic rock, in combination with stones or other hard substances, to form a covering for a road.

5. The mode and use of mastic in the form of sand.

6. The preparation of asphaltic rock in such a manner that, without heat, it shall be rendered soft and binding by beating or rolling, whereby a double asphaltic covering to the road is formed.

Improvements in the Application and Combination of Mineral and Vegetable Products; also, in obtaining Products from Mineral and Vegetable Substances, and in the Generation and Application of Heat. JOHN KNOWLYS. Aug. 9, 1849.

The improvements described in this specification relate chiefly to paints or pigments.

I. The patentee's first product is obtained by reducing silicate of manganese to powder, then grinding it up with oil. The result is a pigment of a light brown color, which may be employed alone, or mixed with peroxide of iron, oxide of zinc, or other coloring materials, to give them tone and body. Or, instead of the silicate of manganese, corundum, greystone, limestone, feldspar, blue clay, Kimeridge coal, jet, anthracite, any of the varieties of pyrites of iron, iron ores, the residuum of copper, antimony, and arsenical ores reduced to a friable state, and similar mineral substances may be employed. The grinding surfaces are made hollow and kept cold by the passage of cold water through them, and have a motion communicated to them similar to that employed in grinding glass.

II. To purify the crude oxides of zinc, which contain sulphur and other impurities, they are to be dissolved in sulphuric acid, and the solution allowed to stand until the impurities have subsided, when the clear liquor is decanted off, and a solution of carbonate of soda added to precipitate the zinc, which is dried and reconverted into oxide of zinc, when it is ready to be used as a paint or pigment. The sulphate solution is converted into the carbonate solution, and rendered again applicable. Hydrochloric, or acetic acid, may be used instead of sulphuric acid. Or, instead of the preceding process, the crude oxide may be ground up with lime or carbonate of lime, or carbonate of lime and magnesia combined.

III. It is proposed to employ the carbonaceous residuum from the manufacture of prussiates of soda and potash as a pigment, also as a manure and deodorant. To render the residuum fit to be employed as a pigment, it is to be washed and ground up with oil, or muriatic acid is added to the residuum for the purpose of combining with the oxide of iron which it contains, and forming a salt of iron. It is then washed in water to carry off the saline and other impurities, and is ready for use. The resulting product is termed by the patentee "horn black," and may be employed as a black pigment, alone, or mixed with any of the substances before enumerated. The residuum may be used as a manure, either as first obtained, or when deprived of its iron; it may also be applied in its natural state to the deodorising of noxious matters.

IV. To clarify and bleach linseed oil, &c., it is proposed to cause it to flow, in finely divided streams, down a tower with glazed sides, and to encounter a current of air forced up in a contrary direction, so that it may be subjected to the action of light and air. The same apparatus, with the addition of steam pipes, may be applied to the evaporation and concentration of syrups and saccharine solutions. Or, instead of steam, cold water may be caused to flow through the pipes, and the apparatus then applied to cooling heated liquids.

V. The last improvement refers to certain

steam-boiler furnaces, which were the subject of a former patent granted to Mr. Knowlys, and consists in causing the flues of two furnaces placed on either side of the boiler to descend, and then turn up and open into a tube, placed concentrically, and within the boiler, which leads to the chimney.

Claims—1. The mode of grinding colors above described.

2. The application of the various substances enumerated under the first head of the specification, either alone or combined with ordinary coloring materials, as paints or pigments.

3. The mode of purifying the crude oxides of zinc by the process above described.

4. The employment, with the crude oxides of zinc, of lime, carbonate of lime, or carbonates of lime and magnesia, combined, for the purpose of rendering them fit for being used with paints or pigments.

5. The application of the carbonaceous residuum obtained in the manufacture of the prussiates of potash and soda, when treated as described, either alone or combined with other materials, as a paint or pigment.

6. The application of the said residuum, either when in its natural state, or when deprived of its iron, as a manure.

7. The application of this residuum, in its natural state, to the deodorising of noxious matters.

8. The employment of the apparatus for clarifying and bleaching linseed and other oils and fats, for evaporating and concentrating syrups and saccharine solutions, and for cooling liquids.

9. The use and application of a pyrometer attached to the subliming vessel.—[A cover is placed on the vessel, so as to leave an air space between the two, to prevent too great a radiation of heat; and the heat of the exterior of the vessel will be indicated by a pyrometer on a dial in the usual way.]

TABLE, SHOWING THE CONSUMPTION OF FOOD AND THE INCREASE OF ANIMAL PER WEEK FOR EACH 100 Lbs. LIVE WEIGHT, AS RECORDED BY VARIOUS OBSERVERS.

Beasts.

Description of Animal.	Number of Animals.	Duration of Experiment.	Authority.	Food consumed per Week to each 100 lbs. Live Weight of Animal.		Increase per Week upon each 100 lbs. Live Weight.
		Wks. Dys.		Description.	Quants. lbs. oz.	lbs. oz.
Oxen	4	5 0	H. S. Thompson	Linseed	0 13¼	1 8
				Bean-meal	2 12½	
				Straw and turnips	..	
Oxen	4	4 0	Ditto	Oil-cake	1 13	1 1½
				Bean-meal	1 13	
				Turnips	..	
Oxen	6	22 0	Mr. Postle	Peas.....	1 13	0 14
				Linseed	0 8	
				Turnips	64 0	
Oxen	6	22 0	Ditto	Oil-cake	3 5	0 13½
				Turnips	66 0	
Oxen	27	9 0	J. H. Leigh....	.. ..	..	1 4½
Oxen	30	10 5	Ditto	.. ..	..	2 12

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

SANITARY NOTES.

NO. VI.

MUCH diversity of opinion has been expressed with respect to the propriety of permitting or forbidding a practice, which has obtained to a great extent in all crowded towns, viz., building houses in courts and narrow streets, back to back. The reason given for not forbidding the practice is that houses may be ventilated without having a space at the back, and that such a regulation would act as a private injury, the interests of the landlord being affected by the number of houses that can be put on the ground. Now here is a point in which that golden maxim "Property has its duties as well its rights," is most applicable. Property has certainly the right to possess as large a material value as possible, but it has no right to swell that amount in its private ledger, by abstracting from the public ledger of health even one iota of spiritual value—its paramount duty is the social one of contributing to the public weal; and this is inconsistent with the construction of dens of filth, disease, and infamy.

That houses for the poor who congregate generally in large numbers, can be constructed back to back with proper attention to sanitary requirements, must be broadly denied. To construct privies in front, in the public way, is an outrage to public decency; to construct water-closets in houses, which are the resort of the poorest, would simply be a waste of money and a creation of a positive evil in the house. Next to the indiscriminate herding together of the sexes at night in the same room, as in the common lodging houses, there is not a more active provocative of public immorality than the public situations and scanty numbers of these necessary accommodations: their construction ought to be regulated so as to secure both privacy and freedom from effluvium in the houses. Again, no competent plan has yet been proposed for ventilating the rooms of back to back, and, therefore, the poorest houses. All kinds of apertures, whether covered with perforated plates or not, will, invariably, in a short time, be covered up in some way. The proposition of air flues, for inducting fresh air and educting the vitiated air, is a hopeless one for houses where there are often no fires to set the currents in motion, and prevent the flues becoming, like sewers, the depositories of decomposed air and noxious gases. In houses of this kind, where there are small fires, every channel will be speedily stopped which can increase the consumption of fuel. No plan will ever succeed that depends (as some professedly do) on the want of penetration of the poor. The main requirement must be to give plenty of air around the house. The importance of a full circulation of water has been already insisted on in these notes, but a full and free circulation of air is fully as necessary. So great, indeed, is the evil of stagnant air, that in some deep gorges in high mountain lands, the scanty inhabitants are almost constantly afflicted with scrofula and consumption, owing to the non-circulation of the air; as from the prevalent direction of the wind, in relation to the peculiar position of the gorges, it seldom blows into them, and the air is therefore seldom changed.

Sufficient has been said on this part of the subject to justify the conclusion that the Legislature ought to provide that all courts should be open at both ends; that they and the low-class streets should have a width in some degree proportionate to the height of the houses on each side, and such width should never be less than twelve feet; that the back space between rows of houses should be of equal width to the front space; and that there should be proper private accommodation for the corporal necessities of the inhabitants.

There are two points in the construction of houses which it is possible to regulate; viz., the height of the rooms, and the quantity of window space. Known instances of the habitual crowding of human beings into confined spaces are so numerous and well-established, that it is impossible for any one to ignore all knowledge of the facts. The foul stench of the steaming cauldrons, which many of the public lodging rooms really are, has been feelingly described by the frequenters of such places; the bodily oppression, sickness, and headache which follow a few hours spent in such rooms are but a natural consequence, and one directly leading to a high rate of mortality. The same remarks apply to those houses inhabited by artisans, where manufactures are carried on by day, and the family sleep by night in the

same room. Now, the evils here alluded to are at least capable of mitigation by legislative enactment. Each grown person inhales about 300 cubic feet of air in the course of the night. If, therefore, six persons are sleeping in an apartment 12 feet square and 7 feet high, they have little more than half the quantity of fresh air to breathe that they require, and of course the remaining half is made up by the vitiated air they have exhaled, and which is no longer fit for use; but if it were obligatory that a room 12 feet square should be 9 feet in height, those 6 persons would have each 264 cubic feet of fresh air out of the required 300, and would, therefore, inhale during the night only 36 cubic feet of vitiated air. It will always be difficult, if not impossible, to regulate the number of persons that shall be admitted into private apartments; but there is no difficulty in securing to them a reasonable amount of air to breathe, by regulating the height of rooms according their areas.

With respect to window space, all that is asked at present is, to "leave it alone." The window-tax is, emphatically, a tax for the promotion of public ill health, and the encouragement of filth and vice. The rigidness with which it is enforced, too, is almost marvellous. It not long ago happened that an architect, in his desire to secure a good ventilation for some parts of a building, contrived to bring his air channels under the door-steps, and there in nearly absolute darkness, he made an opening in the wall. That opening was taxed as a window, and was, therefore, necessarily closed. There will be no use in providing back spaces for low class houses, unless there can be windows in the back wall; and there will be neither staircase nor other supernumerary windows there, as long as this tax exists. Great is the anxiety, and careful are the calculations of a builder of third and fourth rate houses, to build as much house with as little window as possible, so as to avoid the grasp of the infamous window tax. It is vile hypocrisy to attempt to improve the health and morals of the poor, without making reference or allusion to this prime promoter of all that is bad in both, the connection of darkness and vice is of ancient date, and is marked in lofty words—"They love darkness rather than light, for their deeds are evil."

In the model lodging-house in Spitalfields, an excellent ventilation has been contrived, so that in the large coffee-room, even when filled, the air is quite pleasant. But this has been effected by the adoption of an extensive arrangement of flues, fires, and a shaft 100 feet high—means quite inapplicable to ordinary houses, though, doubtless, well arranged for a public building. At the New Fever Hospital at Islington, an ingenious and simple plan has been provided for the escape of the vitiated air. It is founded on the principle exhibited in the following experiment—Hold a straight piece of tobacco-pipe, or similar tube, near a piece of thin card; put the pipe in your mouth and blow hard through it. The card will remain suspended in close proximity to the pipe. The air, meeting at first the resistance of the paper, escapes in a curved form in every direction, and any dislocation of the card would produce a vacuum in the point of separation of the curves, which is, of course, immediately opposite the line of forcible expulsion. The pressure of air on the back of the card at that point keeps it, therefore, in place. This has been applied as follows: a narrow slit is made across the ceiling of the wards at the space between each of the joists; these slits communicate with longitudinal airways through the joists, which are brought over the centre of the wards to a vertical shaft passing out through the roof. Over the shaft is placed a rectangular head, extending a little on each side of the shaft, of such a form and size that the areas of both ends of the head are about equal to the area of the shaft. Thus the wind blowing in at one side of the head cannot pass down the shaft, for then it must draw in from the other end, and a vacuum would take place at the junction of the curved currents; but it must blow through the head, and thus give an upward motion to the air in the shaft.

It is very much to be desired that, in private houses, more attention were paid to a proper ventilation of the rooms, which are often "crowded to suffocation" by visitors and parties. A return to the elegant practice of ornamenting ceilings would give ample opportunity for screening the apertures of escape, which ought to be either numerous or connected with the warm air of the chimney. It is a great mistake to suppose that one or two simple outlets in a ceiling are sufficient, for in that case instead of their being space for the bad air to escape, there is merely a provision for the falling down of the heavier body, viz., the cold air, and, consequently, the more thorough remixture of the vitiated air in the atmosphere of the room. When proper means are provided for the escape of the bad air, good air will almost always find its way in; but a more scientific plan is, to provide for its admission, which may be done by means of flues introducing the air into the neighborhood of the fire, and then distributing it round the skirting of the room.

In the great majority of shops, workshops,

and other large buildings, whether private or public, light, and sometimes warmth also, is obtained by means of gas; there is, moreover, a rapidly-increasing extension of the use of this article in private houses. This, which should be and might be, in every sense of the term, a boon to the dwellers in countries where the nights are long and the days are often dull, is but too frequently a great evil. The impurities of gas, as generally made, are so very great, and their effects in combustion so noxious, that, when much used, the atmosphere of the rooms frequently becomes so bad as to produce fainting and sickness in many persons. Here we have an instance of English perseverance and caution, for which the more appropriate names would be obstinacy and dullness. A discovery is made of certain methods of producing gas (the hydro-carbons) for burning, by which a better light is obtained at a very much reduced cost, and which is entirely free from noxious impurities; yet, though this gas is in use, and its properties daily proved in several large establishments in the country, and in one or two small towns, the large towns are perfectly apathetic on the subject, and consent to go on being poisoned, rather than take the trouble to oblige the gas makers (who will not act except on compulsion) to give them better gas, at a less price, and more profitably than at present. Considering the great extension of the use of gas, this question is really a very important one in the sanitary economy of a town population.

There are great objections to be made to the use of "stoves" for warming rooms. On this subject, a quotation may be made from a letter by Dr. Murray, published in the *Mining Journal*—"I repudiate all manner of 'stoves,' of whatever kind they are, whether made of cast or wrought iron, and for this plain reason, that they one and all decompose the aqueous vapour of the atmosphere hygrometrically suspended therein, and, appropriating the oxygen, liberate the hydrogen in combination, it may be, with sulphur, and even arsenic, as well as other noxious materials. They also char and decompose the organic matter, animal and vegetable, contained in the atmosphere. These are the sources of the noxious effluvia incessantly arising from their surfaces, and which are ofttimes almost insupportable. Our open fireplaces are the chief guarantees of public health." There is less objection to be made to the use of stoves in shops and churches, when, from the frequent opening of the doors, there is a constant change and renewal of the air, than under any other circumstances.

The subject of ventilation is one of the highest importance, and worthy of the studious attention of every scientific man, and every lover of his species. To such it is commended with the sincerest assurance, that any information or observations illustrative of the principles or sound practice connected with this difficult subject, will be most welcome; for any matter bearing on the sanitary condition of the people is happily now estimated at its true worth. The scientific man will naturally seek to diminish the sickness and high mortality of the community generally; the moralist will direct his attention to a diminution of crime, and the removal of its chief incentives. Indeed crime is an expensive article. In Liverpool authentic returns proved, a few years ago, that the cost of crime in that town, was £700,000 annually and that the crimes represented by that enormous sum, had its origin and extension from the dens of filth, darkness, and misery, in the courts and cellars.

Men of England, Christians as you are, remove such stains from your fatherland. Bid the thirsty drink pure water; and the poor and wretched wash and be clean; enable them at least

"To draw a purer breath,
When nature sickens and each gale is death."

Insist that the productions of your talents shall not be neglected, but shall be allowed to bear fruit for the increased comfort and consolation of your fellow beings; and the blessings of millions both now, and in generations yet to be born, will attend and crown the memory of your names.

J. N. W.

THE THAMES.

It appears from the Registrar General's returns, that the mortality from cholera in London, during the past year, was lowest in the two north-western districts, supplied with water from Kew and Hammersmith; the average rates being 10 and 17 in 10,000. And that the mortality was highest in districts supplied with water from between Battersea and Waterloo bridges; the rates varying from 31 in the Belgrave district to 268 in 10,000 in Rotherhithe. The mortality in the districts supplied by the New River Company, from Amwell and the river Lea, varied from 19 in Clerkenwell to 96 in 10,000 in the parts bordering on the Thames; the average being 48. In the districts supplied by the East London Company, from the river Lea, the mortality varied from 49 in Stepney to 95 in 10,000 in Bethnal-green; the average being 69.

The following also appears from the same authentic source. The mean temperature of the Thames, at night, from May 27th to Sept. 15th, was 64°, and the mean lowest observed temperature of the air was 52°; so that the wide simmering waters (from a surface of 2,245 acres) were breathing into the sleeping city tainted vapors, which the temperature of the air could not sustain.

In the last week of May, the temperature of the Thames, at night, rose to 62°, and remained above 60° until Sept. 15. The deaths from cholera during those 16 weeks were, respectively, 9, 22, 42, 49, 124, 152, 339, 678, 783, 926, 823, 1,230, 1,272, 1,663, 2,026, 1,682. In the week of Sept. 16-22, the mean temperature of the Thames, at night, fell to 56°, and the cholera deaths to 839. The temperature of the river then fell gradually to 38° in the last week of November, and the cholera deaths to 1.

Let the Commissioners of Sewers, as well as the water suppliers, beware. The inhabitants of London will no longer consent to be murdered.

WATER SUPPLY.

In reference to the question of an improved supply of water to the metropolis, which has at length become sufficiently important for Government consideration, we would briefly say, that in whatever measure or measures may be introduced by the Government, one special provision must be made, viz., the administrative powers must be placed in the hands of a commission responsible to the ratepayers, subjected, nevertheless, to Government supervision. We do not think that the public will be, or ought to be, satisfied with less than this in any change made in the control over the distribution of this important article of domestic economy. Water is, indeed, one of the most important items of man's subsistence, and, consequently, ought not to be made a commodity of traffic by commercial bodies. We admit that the question is attended with some difficulties, but not, in our opinion, insurmountable ones. Past mistakes of the Legislature have to be acknowledged and remedied, and the regulations under which a supply of water should be afforded must resume their original municipal importance. Every step must be retraced, even as far back as the transfer of the city privileges to Peter Morrys, the Dutch engineer, who, in the year 1580, entered into a commercial arrangement with the then city authorities, at a nominal cost to himself of only 10s. per annum, to rent the right to supply the inhabitants with water from the river Thames, with the liberty of charging what sum he thought proper for such supply. This was the virtual annihilation of the immemorial right of the public to a supply of water, at the mere cost of conveyance. Since then, legislative enactments have perpetuated the same error; and hence, we now find ourselves bound hand and foot by an oppressive monopoly, in an article of subsistence which the Almighty's creative scheme provided to aid in sustaining that life which man cannot bestow. And against such monopoly we have now no means of appeal or redress. Water, light, and air, ought to be as free to the people as the Creator has afforded them; and since the health and the life of the inhabitants, more or less, depend upon them, in their natural abundance, we hold it to be a sacred duty on the part of Government to render them attainable without any fiscal imposts.

That an equitable arrangement may be made with the existing companies, securing, at the same time, great and lasting beneficial results to the public, we have not had the least doubt, since we heard Mr. Tabberner's lecture on this important subject on the 4th ultimo. After explaining the various sources, which may be made available to improve the present inadequate and impure supply, he ably pointed out how Government might effectually deal with all the difficulties connected with this apparently complicated question. We have not space to follow him through the whole of his lecture, but we feel quite certain that if his plan of incorporating the whole water supply of the metropolis into one public institution, as public property, could be carried into effect, it would in due time completely remedy all the existing evils, and effect a saving to the public of an immense annual sum. We can only, in this No., briefly allude to Mr. Tabberner's observations relative to a supply of water being obtained from the chalk formation. He most certainly carried conviction to our minds, by the many important and interesting facts he explained and illustrated by geological diagrams, to show that an abundance of water may be derived from the chalk stratum under London; and we left quite convinced that the inhabitants of the metropolis need not be under any apprehension of a deficiency of water, if only ordinary intelligence be brought to bear on the subject—either from the surface around us, or from the depths beneath. He satisfied us that wholesome water, in multiplied abundance, is at hand for all our requirements, and only

awaits the passing of a judicious measure under which it may be conveyed to our dwellings at the least cost.

Next month we intend to follow Mr. Tabberner through some of his geological illustrations and arguments, and also afford an analysis of the waters in the various deep wells in and around London. He distinctly asserted that sea water is not to be found in the wells sunk into the depths of the chalk, as is stated to be the case by Mr. Braithwaite, Mr. Clutterbuck, and other gentlemen who have taken a prominent part in endeavoring to arrive at something like a feasible elucidation of this very interesting, but, as yet, imperfectly understood subject. We will, however, make an effort to put this part of the question at rest, and, if we find the different scientific points, which Mr. Tabberner urges in support of his views, to be correct, most certainly many of his arguments will be fully borne out—indeed, incontestibly proved.

ON THE MOST FREQUENT AND LEAST KNOWN CAUSE OF THE ACCIDENTS OCCASIONED BY THE INHALATION OF CHLOROFORM.*

BY M. ANCELON.

Almost all surgeons have had occasion to observe patients who, when submitted to the action of chloroform, cry, gesticulate, struggle, and push away the apparatus, as if impelled by an instinctive horror. Whence arises this agitation, this powerful desire for wrestling, followed by death, under three or four well proved circumstances? The question, whatever may be said, still remains to be decided. The data of a problem which we possess have been sought far and wide. The cries, the gestures, the frightful agitation, observed in certain subjects under the influence of chloroform, indicate much less the normal, but accidentally injurious, influence of the anæsthetic substance, than its perfectly unseasonable application. Contra indications have been admitted in certain pathological circumstances, but it has been forgotten to add to these the no less real danger incurred by derangement of a great physiological function, the digestion.

We need not here dwell on the agitation or asphyxia, caused by want of caution on the part of the operators; the suspension of the respiratory organs, by complete occlusion of the mouth and nostrils, by means of a handkerchief imbibed with a few drops of chloroform, would be, with every one, an unpardonable practice.

We may call to mind the difficulty of employing chloroform of bad quality, especially that containing acetone; its insupportable odor, and its irritating action, give rise to accidents, whose seriousness should cause its use to be rejected.

But the first remark to be made, since no one has made it before us, is, that there is actual danger in the too rapid volatilisation of chloroform, when it is administered to the patients, without admixture of atmospheric air, in a medium of too high a temperature. In this too rapid evaporation, may we not find one of the causes of the misfortune which occurred to an English dentist and a French physician, who had employed only 15 to 20 drops—a small teaspoonful?

Before going further, it is important to make known our mode of administering chloroform, and the conditions we impose on our patients (Hôpital de Dieuze, Meurthe). Our apparatus consists only of a napkin, rolled into the form of a horn; at the bottom of this horn, which is well closed, is a sponge which we moisten, as required, with the anæsthetic agent. With the wide part of this horn we cover the nose, mouth, and chin; but the occlusion of the nostrils and mouth is not so complete but that a small quantity of atmospheric air penetrates; the cavity formed by the horn must be sufficiently deep, and the sponge proportionately small enough for several inches of vacuum to exist between the sponge and the nostrils and mouth.

On the part of the patients we require:—1. Large clothing, in which the chest can act freely. 2. The stomach perfectly empty; for, if we consider the inhalation of chloroform fasting as free from danger, we are persuaded that the indigestion caused by it is always serious, and, perhaps, speedily fatal. It is sufficient, indeed, to recollect what occurs in serious indigestion; to reflect on the action of powerful odors and of deleterious gases on the pneumogastric region, and the disturbance of the stomach in the state of fulness; on the extreme distension of this musculo-membraneous bag by the food and the gases which induce, by compression of the vessels, embarrassment of the venous circulation, and which constrain and press the lungs and heart towards the upper part of the thorax; it is sufficient, we say, to have all this mechanism present to the mind, to account for the accidents caused by chloroform: these are in relation, at all points, with the symptoms of serious indigestion, especially of that kind which was formerly called gastric apoplexy. The more

* *Comptes Rendus*, No. 1, 7th January, 1850.

the stomach is embarrassed at the moment of inhalation, the greater is the agitation, the longer is it before insensibility is induced; the more are we compelled to have recourse to additional doses of chloroform, and, finally, the more imminent is the danger.

The two series of observations detailed in my memoir are intended to support the considerations above enunciated; the first series contain facts favorable to the assertion that chloroform, administered fasting, is entirely free from danger; in the second, I give a very considerable number of observations tending to demonstrate that it is always imprudent to surprise the stomach when in operation by the anæsthetic action of chloroform.

After having considered these observations, I hope that the Commission will be disposed to admit, with me:—

1. That chloroform, to produce promptly and easily insensibility free from danger, should invariably be employed fasting, and with certain precautions.

2. That, as often as the stomach is not empty, chloroform produces agitation and anxiety.

3. That its anæsthetic influence appears insufficient, and exposes us to giving doses incompatible with life.

4. That death may supervene during anæsthesia, if we do not ease the stomach of the weight of the food and of the pressure of the gases which encumber it, and which, moreor less, mechanically suspend the venous circulation.

ON THE MODE OF ACTION OF STRYCHNINE.*

In a communication made to the Biological Society of Paris, Mr. Brown-Sequard proposed to demonstrate that strychnine acts on the spinal marrow, and not on the nerves serving sensibility, as Stermius and some other physiologists have supposed.

If the ligature of the aorta be operated on a little before its terminal bifurcation, in a frog, in such a manner that the posterior members shall receive no blood, and if the animal be afterwards poisoned with strychnine introduced into its mouth, the ordinary symptoms of this poison are promptly seen in the four limbs. If, on the contrary, we poison in the same manner a frog in which, after having divided the spinal marrow at the origin of the brachial nerves, all the arteries going from the aorta to the *rachis* are also cut, the symptoms of poisoning do not supervene in the posterior portion, although the reflex action continues in it for half an hour, or rather more, in summer, and about two hours in winter.

In the first experiment the sensible nerves of the posterior members do not receive strychnine, whilst the spinal marrow receives it; we see tetanic symptoms in the posterior limbs.

In the second experiment the portion of marrow separated from the brain does not receive strychnine, whilst the nerves of sensibility of the posterior members do receive it, and yet tetanic symptoms do not show themselves.

There is, therefore, reason to conclude that it is indeed on the spinal marrow that strychnine acts, and not on the nerves of sensibility.

* *Gazette Medicale de Paris.*

NEW ANÆSTHETIC AGENT.*

BY J. RAMES.

If we may be permitted to form conclusions as to the therapeutical effect of a substance, from a single observation, bromide of potassium appears to possess remarkable anæsthetic properties. In the dose of 20 grammes per day, it almost always causes in the patient a peculiar intoxication, consisting of a state of torpor and somnolency, lasting for several days. In Pierre Dunaux, aged 32, who entered under the charge of M. Puche, on the 17th of September, 1849, for tertiary symptoms, this intoxication was accompanied by so great insensibility that he was pinched, pricked with a pin, and scratched with a flat suture needle, without feeling. The conjunctiva was touched with a feather, causing contraction of the eye-lids, and tickled at the back of the throat without nausea ensuing, and yet he retained his full intelligence, and lent himself to all the investigations. This fact, witnessed by M. Puche and M. Ricord, appears so much the more conclusive as the insensibility was co-existent with considerable disturbance of the senses, and the power of locomotion, already noticed several times, during the treatment; as the insensibility which was decided on the 21st Oct., in the evening, when, after three days the patient had arrived at taking 20 grammes of bromide of potassium per day was diminishing, as well as the disturbance of the senses and locomotion, until the 29th, when Dunaux recovered his normal condition. The medicine was suspended on the 22nd October.

Is this effect constant? This, the study of several patients who have already been taking the bromide for some time, will shortly enable us to determine.

* *Journal de Chimie Médicale,* Jan., 1850.

NOTE ON THE PHYSIOLOGICAL ACTION OF ETHER, CHLOROFORM, AND ANALOGOUS ANÆSTHETIC AGENTS.*

BY M. E. ROBIN.

The author admits, with several physiologists who have studied this question, that the anæsthetic action of these substances is the result of a more or less complete state of asphyxia. Now, this asphyxia is produced, according to him, because the vapors of ether or chloroform, which penetrate into the lungs, prevents the oxygen of the air which enters into the lungs with them from exerting on the lungs the action, which is the principal result, the object of the action of respiration; because these vapors shield the blood contained in the capillary vessels against the action of oxygen, as fluid, ether, and chloroform, protect from the same agent a piece of muscular flesh, or any other pulpy animal substance steeped in them.

A FRIEND OF LIEBIG'S FAREWELL REPLY TO "ALPHA."

To the Editors of The Chemist.

Gentlemen—I would not have condescended to answer "Alpha's" last note, had he satisfactorily replied to mine; but, as he has so egregiously committed himself, I will endeavour, for my amusement, to set him right. "Alpha" denies claiming for a certain person equality with Liebig. In his first letter he claimed, *in decided terms*, for a teacher of medical jurisprudence, in an institution in Liverpool, equal fallibility with the celebrated German Professor. No more of this. Has "Alpha" named any chemist of note who ever quoted his friend as an authority? He evaded my question. What is "Alpha's" reply to the opinions of a first class analyst here, on his pet authority on poisons? None! What remarks has he on the following:—"I found mercury, lead, and arsenious acid, all capable of rendering albumen insoluble, and also of forming indefinite chemical compounds with it." He is silent.

Further, he does not give me even a *homœopathic dose* of his malice, upon the business engagements of certain druggists, and his *protegé*. "Alpha" writes, "in what manner these things can affect the solubility of albuminous compounds or the right of private judgment among philosophers, we cannot imagine."

Will my oppositionist tell me what Liebig's remarks upon Mulder and Berzelius have to do with arsenious acid? *He* first stepped from the question at issue, and why? Because he knew, in his own mind, that Liebig was right; and now he endeavors to bolster up his miserable cause by stating absurdities. A Mr. Edwards is brought into "Alpha's" epistle. I do not know that Mr. Edwards has ever done anything either in the qualitative or quantitative line. How dare, then, "Alpha" mention him in conjunction with so great a question? Analysis and correct results cannot be arrived at by the tyro, but only by the proficient who has devoted his whole lifetime to the study of chemistry. I am an independent amateur, and follow chemistry, not for *gain*, but for *fame*; and, if Mr. Edwards will *accurately* analyse an antimonial lead ore, in the presence of any acknowledged skilful chemist, I will give him £50, and if he will make an organic combustion of sugar *to agree with theory* I will give him £100. I ask the chemical public whether this be fair? If he cannot do these things, how can "Alpha" speak of a paper of his being read at the Chemical Society, and upon a determination *far more difficult* than the two I have mentioned.

Baron Liebig has stated, in his admirable work on "Agriculture and Physiology," that arsenious acid combines with albumen. My friend, the spirited founder of the Liverpool College of Chemistry, has perfectly proved, in your last journal, the eminent German's statements; and, moreover, brings forward to support him, some of the best names in Europe—Graham, Sir Robert Kane, Professor Gregory, Dr. Taylor, and Dr. Anderson, a pupil of Berzelius, but I think he needs no supporters to his statements, derived from his own experiments (?) He is spoken of by Berzelius, Liebig, Will, Rose, Kane, Hoffmann, Dumas, Laurent, Bunsen, Gmelin, and a host of other brilliant phisophers, as one of the most accurate chemists in Europe; and although his results and theories have been published in every standard work of Chemistry, I do not know that *one of them* has ever been doubted or confuted. Let this speak for itself. I am proud of the friendship and intimacy of most of the leading scientific and literary men of the day; this, alone, ought to have prevented me taking up the cause of "Liebig *versus* a nobody." It was, to use a trite phrase, and one which has heretofore been applied with regard to a similar case, "employing a sledge hammer to kill a mite."

Lastly, I do not wish to damage any Doctor's reputation, *for I am an enemy to no man*, but I will not allow the interests of science to suffer by any erroneous statements, set forth with the view of detracting from the meritorious theories of a great and good man.

Yours faithfully,

A Friend of Liebig.

London, Feb. 7th, 1850.

* *Comptes Rendus*, No. 3, Jan. 21, 1850.

LIVERPOOL CHEMISTS' ASSOCIATION.

Royal Institution, Friday evening,
February 15, 1850.

THE PRESIDENT IN THE CHAIR.

DR. INMAN delivered an interesting lecture on therapeutics, considering the specific action of the salts of the metals—as mercury, antimony, arsenic, lead, silver, iron, &c., and quoted many cases in point.

After a few remarks from Dr. Brett on the same subject, Mr. Edwards referred to the debated question of the combination of arsenic and albumen, objecting both to the quotations and experiments of Dr. Muspratt and his pupils, and detailed to the Society some of the experiments he had made, and recently laid before the Chemical Society of London.

He found arsenious acid incapable of coagulating albumen, but when the usual heat was applied, the albumen, in coagulating, carried up some of the acid, and a portion only of this was removed when the coagulate was washed with cold water, but *when triturated* in a mortar with *hot water*, the whole of the arsenic was dissolved out; this was proved by using a known weight of arsenious acid, and precipitating its equivalent of sulphide of arsenic from the washings.

He also found it poisonous; a rabbit and guinea-pig were killed by portions containing about two grains of arsenic in each. Arsenic was found absorbed by the stomach, but the whole was removed by boiling water.

These results were confirmed by a number of experiments, and he considered them conclusive objections to Liebig's views.

Mr. Mercer and Mr. Walker stated they had repeated some of Mr. Edward's experiments, and arrived at the same conclusions.

Dr. Inman will resume the subject at the next meeting.

IV. REVIEWS, NOTICES OF BOOKS, &c.

PHOTOGENIC MANIPULATIONS.

Part I. Containing the Theory and Plain Instructions in the Art of Photography, or the Production of Pictures through the Agency of Light: including Calotype, Fluorotype, Ferrotype, Chromatype, Chrysotype, Cyanotype, Catalisotype, and Anthotype. By ROBERT J. BINGHAM, late Chemical Assistant in the Laboratory of the London Institution. Illustrated by Woodcuts. Sixth Edition. London: George Knight and Sons, pp. 72.

THIS is one of a series of manuals entitled, "Manipulations in the Scientific Arts," brought out by the well-known manufacturers of chemical apparatus, Messrs. Knight and Sons, to whom the world is much indebted for them, and for the introduction of every new chemical apparatus invented, and all new chemical substances discovered—the former of the best construction and workmanship, and the latter of perfect purity.

The little work before us has gone through several editions, and this edition contains several important and interesting additions, the most conspicuous of which is the method of producing photographic pictures on glass plates—"a process which," says the author, in the preface, "judging from what has already been done, bids fair to rival the Daguerreotype in its great delicacy and beauty of detail, whilst it possesses many of the advantages of the Talbotype process."

Mr. Bingham deserves commendation for the very clear and intelligible manner in which he has executed his task. We recommend this edition to all who desire to acquire a practical acquaintance with the beautiful arts it teaches.

We subjoin an extract:—

ANTHOTYPE.

"83. This is a general name given to those methods of producing pictures, in which the colored juices of plants are the photographic agents; nearly the whole have been described by Sir John Herschel. The petal of the flowers should be crushed in a marble mortar and the juice expressed by squeezing the pulp in a clean cloth. It should then be spread upon the paper with great care, so as to be perfectly uniform all over, and then dried by spontaneous evaporation. It is better to add a little alcohol, as it prevents the paper from becoming changed by the air, which sometimes occurs very quickly when this precaution is not taken. The following are some of the results which are mentioned by Sir John Herschel:—The flowers of the *Corchorus japonica* impart a fine yellow color to paper, and, upon exposure to sunlight, in about half an hour it is rendered quite white.

"*Common Ten Weeks' Stocks.*—Papers prepared with the alcoholic extract of this flower are of a very bright red, and are sensibly decolorated in a few hours. The red poppy, *Papaver rhœas*, gives a very beautiful red color, which is speedily bleached by the light, giving a positive picture.

"If tincture of turmeric is spread upon paper, it is slowly acted upon; if slightly browned by an alkali, it is a little more sensitive. The *Viola odorata* gives to alcohol a rich blue color, which is pretty rapidly bleached by light. The juice of the *Mimulus Smithii* gives a yellow color, which is discharged by sunshine. The *Ferrarea undulata*, a dark brown flower, yields a juice

which, if spread upon paper and exposed to light, turns to a blue. The French marigold, *Tagates patula*, imparts a color to paper which passes rapidly from a brown to a green. We have lately found that the infusion of saffron in water washed over paper is very sensitive to light, the paper is quite bleached by strong sunshine in about ten minutes. Sir John Herschel, in his memoir, enumerates a great number of other flowers, the colors of which are modified or discharged by light; he also gives the result of his experiments with them when acted on by the different colored rays of light; he shows that the most active rays of the solar spectrum in discharging these vegetable tints are those which are *complimentary* to the colors themselves: thus the yellow ray of the spectrum will speedily discharge vegetable blue or purple, but will act very slightly upon yellow or orange, whilst the indigo and blue rays will speedily discharge these colors. It is worthy of remark, *en passant*, that the ordinary argentine photographic papers are most acted on by the *invisible rays* accompanying solar light; but those anthotypic preparations are only affected by the *colored* rays of the spectrum.

"Dr. Draper and Mr. Hunt have followed out this subject in its more extended view, viz., the action of light upon plants, but they appear to differ in many of their results, probably owing to the difference of the light they operated with, one living in England, the other in America. Mr. Robert Hunt placed seeds under different colored glasses; these seeds were found by him to *germinate* under the yellow glass, but were not found to live and flourish; however, if removed, after germination, and placed under the blue, they grew and were very healthy. Mr. Hunt has been commissioned by the British Association to pursue this subject. From the investigations of this gentleman, it is certain that the whole of the carbon of a plant, and which constitutes the greater part of its solid matter, has been derived from the atmosphere in which it exists united with oxygen and carbonic acid. This carbonic acid is decomposed by plants, when under the influence of light, into carbon and oxygen gas; the plant assimilates the carbon, and forms it into organised matter, and oxygen is liberated. Now this occurs just according, and in proportion, to the amount of light, or rather, to the quantity of actinic power existing at the time; for it has been shewn, that under yellow, green, or red glasses, plants grow but very imperfectly; or, in other words, they are unable to decompose the carbonic acid, in consequence of the absence of the chemical or blue rays. Every person must have noticed the sickly appearance of vegetation, if grown in a place where light is partially excluded; the leaves are nearly white, and if the plant does flower and bear fruit, the leaves are pale and scentless, and the fruit insipid. We have familiar examples of this when the gardener wishes to bleach celery or endive: he covers up the plants with earth, light is excluded, and they become quite white; the interior of a cabbage is white, and for a similar reason. These are interesting facts, for they show how mutually dependent animals and plants are one on another. It is absolutely essential to animal life that the requisite quantity of oxygen should exist in the air, which myriads of animals are continually abstracting, in order to keep up a process of combustion, the product of which is carbonic acid; for on inhaling the oxygen from the air, it combines with the carbon contained in our bodies, and forms this noxious gas, which is exhaled, and deteriorates the atmosphere. Now, under the influence of light, this carbonic acid is decomposed by the vegetable kingdom, and pure oxygen gas set free, to be absorbed by animals. In the words of Mr. Hunt, 'It is not possible to conceive a more perfect or more beautiful system of harmonious arrangement than this. If the vegetable world was swept away, animal life would soon become extinct; and if all animal existence was brought to a close, the forest would fall, and the flowers of the field, which now clothe the earth with gladness, perish in the utterness of a lamentable decay.'"

TO CORRESPONDENTS.

Correspondents who will send their addresses shall receive private letters; this month we have not room in the work.

ERRATA IN MR. GRIFFITHS'S FIRST LETTER.—No. V., page 209, second column, line 30 from top for "traces" read "there were traces." Page 210, second column, line 6, dele "if any were used;" line 7, dele "and" read "the article is then removed and placed in a solution," &c.; line 26, dele "and as" read "These metals are fused, &c.;" line 29, read "Filagree work is seldom made of 22 carat gold, but may be found occasionally in Indian ornaments, where, sometimes, the gold is worked nearly pure;" line 13 from bottom, for "a saline solution," read, "the saline solution."

NOTICE.—*All Communications and Books for Review must be addressed* "To the Publisher of THE CHEMIST, 17, Surrey-street, Strand, London." *Communications must be pre-paid, and sent before the 15th of each month. Books for Review before the 10th.*

THE CHEMIST.

[NEW SERIES.]

I. CHEMISTRY.

VARIOUS CHEMICAL FACTS APPLIED TO PHYSIOLOGY.*

BY M. BARRESWIL.

THE facts which form the subject of this communication should not be published separately; some of them belong to a *Memoir on Fermentation*, the first part of which I hope soon to publish; others, to a series of investigations concerning the secretions, of which M. Bernard and I have made known a certain number of results in communications made together and separately. I am induced to make an abstract of these unpublished works by the announcement I have seen, in the *Journal de Pharmacie*, of the discovery of sugar in the albumen of the egg. This fact, which I had observed before the date of the memoir which M. Bernard and I addressed to the Academy on the existence of sugar in the liver, is within the knowledge of MM. Pelouze, Dumas, and Thénard. It was too intimately connected with those which I had observed, in my work on fermentations for me to detach it from the memoir, more especially as it had lost much of its importance in consequence of our publication on the presence of sugar in the liver.

I am far from thinking that the knowledge of this result had come to any one except from his own experiments; but as I think it would be unjust to accuse the author of spoliation, so I regard it as due to myself to claim at least simultaneousness, and to publish at once such of the facts I have observed as are known to all my friends, and which might indeed, like the first, not escape the investigation of chemists, for, like it, they relate to albumen. I reserve the others for the publications which I have announced above.

SUGAR IN THE EGG.

From the numerous experiments which I made in M. Pelouze's laboratory, it results that white of egg contains sugar. This may be proved as follows:—The white of egg is put into a mortar; five or six times its bulk of alcohol at 40° is added; the whole is mixed; the coagulum is put on a cloth; the liquid which flows out is filtered through paper, and it is treated directly with the test for sugar, the preparation of which I have described (alkaline tartrate of copper and potassa). The albumen may be more simply tested directly with the test liquor. It may be objected to this method that other substances than sugar possess the property of reducing binoxide of copper; I have myself noticed several. Uric acid and allantoïn do so: I did not rely on this character alone. I submitted the saccharine liquid extracted from the egg to the action of beer yeast, and it speedily fermented, disengaging carbonic acid, and I procured alcohol from the fermented liquor. As there might have been some doubt, owing to my having employed alcohol in the preparation, I operated directly on the mother liquors of albumen coagulated by heat, purified by acetate of lead, and separated by means of sulphuric acid from the excess of oxide of lead.

The fermentation with disengagement of carbonic acid and formation of alcohol leaving me no longer any doubt, I concluded on the presence of sugar; and as the fermentation was immediate, I had no doubt that I had grape sugar and not sugar of milk, both of which act alike with the oxide

* *Journal de Pharmacie*, Feb., 1850.

of copper test, but which differ in the mode in which they act with ferments. However, to completely elucidate the question, I endeavored to obtain the sugar isolated and crystallised; here my results no longer agree with those which I have related; I have not succeeded, like the author whom I mention, in making the sugar crystallise, perhaps because I did not operate on sufficiently large quantities; be it as it may, I have proved this curious fact, that sugar diminishes rather than increases by the concentration *a priori*; I attributed this phenomenon to the presence of an alkali which, in concentrating, modified the sugar, and experiment has confirmed my anticipation.

CAUSE OF THE ALKALINITY OF THE ALBUMEN OF THE EGG.

Much has been written concerning the causes of the alkalinity and acidity of animal and vegetable liquids, and especially of albumen, whether of the egg or of serum, and the various authors have often contradicted themselves. The character of the persons to whom these works are owing does not admit of their assertion being doubted, and it is only in the circumstances in which they have been placed that we must seek for the cause of these differences. Indeed, we likewise well know that the mother liquor of coagulated albumen supposed to be free from carbonates, contains them, owing to the destruction of a salt of soda, from the very fact of concentration; or else that the same water containing a carbonate before concentration, may contain it no longer after reduction, owing either to the destruction of this carbonate or to the alteration of an organic matter in the air (and this is precisely the case with grape sugar); or by the formation and evaporation of carbonate of ammonia. The following is the way in which I operated. I triturated the white of an egg with absolute alcohol, I filtered the liquor into which I passed a current of hydrogen, and which I introduced into a stoppered flask, of which it occupied three-fourths, I filled up the flask with baryta water, then I left it to itself; next day I found a precipitate which, washed by decantation with boiled water and introduced into a small tube, dissolved with effervescence in the acids, thus rendering evident the presence of a carbonate.

It may be said that this experiment does not absolutely prove the point, seeing that the addition of alcohol might singularly modify the nature of the compound, which happens in many cases. Thus, for example, if we had in a liquid an acid phosphate of soda and carbonate of lime dissolved in carbonic acid, the addition of alcohol to such a liquid would cause a disengagement of carbonic acid, and would give rise to phosphate of lime and carbonate of soda, products which, doubtless, did not pre-exist in the liquid.

But, on the other hand, nothing opposes our admitting the presence of carbonate of soda in white of egg, when it is known that this salt may exist in the blood even in very large proportions, and certainly when, for example, the water of Vichy is made use of; and I think that it may be regarded as, at least, very probable that albumen contains carbonate of soda.

I have said above that sugar disappears when the solution is concentrated with heat; this fact is very naturally explained if we admit the presence of carbonate of soda in albumen. We know, indeed, what a profound action the alkalies exert on the sugars of the second species, in contact with the air and at a high temperature. I may add that it disappears spontaneously; it is also indispensable, when we wish to prove its presence to operate on a fresh egg, or at least to precipitate the albuminous solution immediately by alcohol.

I in vain sought for sugar in the yolk of the egg; I found none; must we conclude from this that it had not arrived there, or that the yolk is not secreted by the same organs as the white, or that the destruction of sugar is more rapid in the yolk? This question will find solution in another work; besides, it is rather physiological than chemical. Neither did I find carbonate of soda in the yolk; this circumstance surprised me, since I had attributed *a priori* to this salt the emulsive property of white of egg, and I expected to find it in considerable quantity; I was consequently led to seek in the yolk a principle analogous to, if not identical with, that which the pancreatic juice contains, whose emulsive property has recently been proved by M. Bernard.

EMULSIVE MATTER OF THE YOLK OF EGG.

I took the yolk of a very fresh egg; I treated it with ether free from alcohol; I thus separated from it an etherial solution of oil which floated; the dense liquid separated from the oil and filtered, possessed in a high degree the *emulsive* property; it thus resembled pancreatic juice. I have studied its principal properties, but I cannot at present say anything complete concerning them; however, I cannot avoid noticing one of the most curious characters. When put in contact with amygdaline, it effects its conversion, the same as

emulsine would do. This character, which, at first sight, appears surprising, has nothing in it to cause astonishment. M. Colin long ago proved that the various sulpho-nitrogenous matters of the organism are capable of exciting alcoholic fermentation. MM. Pelouze, Gélis and Frémy have demonstrated that all may give rise to viscous fermentation. What are we to conclude from these facts, unless that the different transformations are due to peculiar ferments, but that these peculiar ferments, principles not yet defined, may all be formed indifferently according to circumstances, by the decomposition of any one of the sulpho-nitrogenous matters of the organism? This is what I shall prove in my work on fermentations, and what is already proved by the observations made by myself in common with M. Bernard, on the saliva and gastric juice. I could not fail to be struck with the simplicity of the means employed by Nature, who, in animals, as in vegetables, proceeds in the same manner, and places by the side of fecula and fatty matter, vegeto-nitrogenous matters, destined, by successive alterations in given circumstances, to form ferments capable of dissolving fecula and of making fat into emulsion.

ACID OF THE EGG.

In the course of these researches, I had occasion to operate on very fresh eggs: I investigated whether or not the yolk is acid, and I have never found the litmus paper turn in the yolk of a fresh egg, at the moment of breaking; but I have frequently observed this character when the egg has remained for a short time in contact with the air: in the same way, I have never found fatty acids in the fresh egg recently broken, and I have found them in the egg after exposure to the air. I have concluded that the cause of the difference which exists between operators likewise, is owing to their being placed in different circumstances, either as regards the mode of operating, or the temperature and time of the experiment.

This ready acidification of the yolk of the egg likewise exists in the pancreatic juice in presence of fatty bodies. But in this case also the character which M. Margueritte and I proved with M. Bernard, is manifested only when the operation takes place out of the animal in contact with the air; for in the body, the fat in the state of emulsion, which is absorbed by the vessels is by no means acid.

It has been established that the acid formed in this case is lactic acid; I am not positive of this fact, and if I revert to it, it is because it is analagous to that which M. Bernard and I advanced concerning the gastric juice, and which has since been proved. We have proved that the gastric juice is acidified by lactic acid; other observers have asserted that it is by hydrochloric acid: on this point I may observe that we may all be right, according to the way in which the proposition is put. The gastric juice contains lactic acid, hydrochloric acid, soda and a quantity of base insufficient for saturating the two acids, so that all the questions consist in ascertaining:—1. which of the two acids is free and which combined: 2. which is formed at the moment of the secretion of the stomach.—Is it produced from the lactic acid which is mixed with common salt? Is it produced from the hydrochloric acid which is found mixed with a lactate?

In my opinion, the acid which is formed is lactic acid. Now this acid being put in contact with common salt, constitutes a mixture which may, in certain cases, present the properties of hydrochloric acid. The solution which I give of the first question is not supported, it is true, by any positive fact, other than that of the experiment itself. There is always more acid than is required for saturating the base, and we always meet with and isolate an acid, which has all the properties of lactic acid, and which is not made turbid by the salts of silver. This lactic acid is also found in the system; it results from the fermentation of sugar, and the experiments made by M. Bernard and myself prove that the blood of animals, (at least of those with warm blood), always contains sugar, even when it has received no vegetable matter, and nothing appears more simple than to suppose that this acid is formed at the very moment of the secretion of the gastric juice, and that by a fermentation as rapid as that of amygdaline by emulsine, which, as every one knows, is effected at the moment of contact.

There is, moreover, an example which I will borrow from our experiments, and which, if I be not deceived, proves to a certain extent by analogy the fact of the production of the acid at the very moment of secretion: if an animal be made to swallow urea, or if it be injected into the blood, it is absorbed, and is added without alteration to that normally found in the bladder.

This fact being proved, if we remove the kidneys of the animal, and, consequently suppress the secretion of urine, (this experiment, which M. Bernard and I have since repeated and commented on, is due

to MM. Prévost and Dumas), it is observed that the urea accumulates in the blood: but, however considerable the quantity which may be extracted from it, it is far from giving an account of the quantity produced: now if we seek by what way, in the absence of the kidneys, the urea can escape, we find that it is by the stomach, which is indeed filled with liquid. But urea, which in the blood is in the state of urea is found in this liquid in the state of ammoniacal salts; the transformation of urea is therefore at the moment of secretion.

The second proposition is this: Admitting that the gastric juice is acid, because lactic acid is added to it, is it to this acid, or to the hydrochloric acid which it would eliminate, that the properties of the gastric juice are due? To that I may reply that it matters little, since M. Bernard's and my experiments have proved that all weak acids act in an analogous manner.

But I have thought it possible to enter further into the question; I think that the following experiment throws some light—I will not say certain, but probable—on the hypothesis that it is lactic acid and not hydrochloric acid which is free in the gastric juice.

M. Payen has shown that starch which is so easily saccharified by the mineral acids, even when dilute, is not so affected by the organic acids. It is on the following experiment that I support my opinion:—I made a solution of commercial hydrochloric acid, 3 or 4 drops in 10 centigrammes; then I separated the liquor into two tubes; into one I added common salt, and into the other acetate of soda, and into each I poured very clear starch in equal quantity, and I maintained both for 20 minutes at the temperature of 100° F. At the end of this time I observed that the starch did not turn blue with iodine in the tube with common salt, whilst it did turn blue in that containing the acetate; I concluded from this experiment that the hydrochloric acid was free in the first tube, whilst, in the second, it was combined with the soda in substitution for the acetic acid which alone was free in the liquor.

CAUSES OF THE DISAPPEARANCE OF THE SUGAR OF THE EGG.

I have always found sugar in the egg. I have not had an opportunity of operating on the eggs of carnivorous birds, and the endeavors which have been made to obtain eggs of fowls fed exclusively on meat, have been ineffectual. However, I have not abandoned this idea, and I intend to return to it.

I will not, therefore, speak here of the case in which sugar might be naturally wanting, but of its disappearance in experiment.

I have said above that when sugar was sought for in the residue of the evaporation of the mother liquor of coagulated albumen, it was not found, or discovered only in minute quantities. I have hinted that the destruction of the sugar should be attributed to the simultaneous presence of carbonate of soda and the air. Indeed direct experiment has proved this: sugar of starch disappeared by the action of the air under the influence of the alkalies. This fact is very important; it proves how, in an analysis, two products may disappear, being destroyed by one another, and how we may meet with principles that do not pre-exist and which are formed in the operation itself; finally, it accounts, I think, for the differences between the experiments of various chemists as to the presence of an alkali in the blood.

The sugar may undergo fermentation, a spontaneous destruction; when the white of egg is exposed to the air, it disappears, and so much the more rapidly as it is diluted: is this phenomenon to be attributed to the presence of the air? I think not. Indeed the egg receives in its very shell the impression of the atmosphere. Above all, the state of dilution must be taken into account; for, I repeat it, the fermentation which takes place slowly in its natural state, is infinitely more rapid in white of egg diluted with water. I could mention several examples of analagous cases, in which fermentation is favored by dilution. It is thus, for example, that the saccharine water of gooseberries, turns sour in one day, whilst preserves of gooseberries, which differ only in concentration, are kept from one year to another.

However, these preserves are not in all cases unalterable, and their mode of alteration, if closely observed, is a proof of the influence of dilution. When preserves are left in a warm damp place, their surface very soon becomes liquid, and the mass gradually liquifies with more or less rapidity, and the alteration, which is slow to commence, proceeds with extreme speed. This phenomenon is owing to the circumstance that, in proportion as the alteration manifests itself, the pectine, being modified, is converted into a matter which retains less water in combination (metapectic acid), and which thus, consequently, the water being set free, modifies the unaltered portion of the preserves, and accelerates the transformation.

This effect is remarked only in a constantly damp place; otherwise, in ordinary circumstances, the paper and sugar with which the preserves are covered is sufficient for remedying, by their hygrometric property, the alternations of wetness and dryness.

The influence of dilution being, I think, undisputed, it remains to be determined in what direction it acts. Is its object simply to permit the air to circulate more freely in the liquid; or does it happen that, from the simple fact of concentration, the ferment or the substance which should produce it is insoluble in the vehicle, unless it be diluted with water, and, from the sole fact of its insolubility, shielded from all decomposition?

This question is of considerable importance, especially as regards the chemical phenomena of life: I have therefore applied myself to its solution. Of a great number of experiments made with this object, I detail the following, which appear to me to give a satisfactory solution.

If we bruise, in contact with the air, a sweet almond and sugar in powder, with sufficient water to liquify the mixture, but not to dissolve all the sugar, and if amygdaline be added to this liquor, the trituration being continued, no odor of bitter almonds is obtained, which is developed on contact with emulsine and amygdaline, and notwithstanding the operation being performed in contact with the air constantly renewed by trituration. The phenomenon being proved, the odor may be developed with the greatest energy, by adding pure and cold water—by *diluting* the mixture.

I selected sugar as an example, because it is employed by every one. I might have been able to employ other re-agents, I might likewise have been able to put in operation another ferment, and another fermentable substance. Thus, I proved that all ferments, and the organic matters signalised by M. Colin as giving rise to ferments, especially to the alcoholic ferments, are in this position.

Albumen appeared to constitute an exception: it is not indeed precipitated in its solutions by common salt, even in great excess. This circumstance was very unfortunate, and to a certain extent an argument against me might be drawn from it,—the preservation of meat by salt. Indeed, if it is true that albumen, in the ordinary state, is not precipitated by common salt, it is sufficient to make it undergo a slight modification to render it precipitable; its alkali must simply be saturated with a trace of vinegar or lactic acid; for this circumstance is precisely that which always presents itself. It is well demonstrated that the first degree of putrefaction in albuminous solutions, such as broth, &c., manifests itself by acidity. Moreover, this precipitation of albumen must not be confounded with coagulation by heat or by alcohol. Indeed, the coagulum formed is soluble in water. This anomaly which albumen presents in presence of common salt does not exist in the case of other precipitants. Thus, for example, sulphate of soda precipitates it when it is alkaline; the same salt precipitates not only the ferments, but gelatine, starch and gum.

When the experiment of the precipitation of albumen by sulphate of soda is repeated, one precaution must be observed in order to obtain a result which leaves nothing to be desired: to maintain the albumen at a temperature of about 90° F., the maximum of solubility of sulphate of soda. Within and beyond this limit, the precipitation is not complete. So that the solution of albumen supersaturated with salt at 68° F. becomes turbid when raised to 90° F., and becomes clear again when that limit is exceeded. *This experiment is remarkably clear.* It should be taken into consideration in the analysis of the blood. Direct experiments have demonstrated that the globules were not the only matter eliminated. I shall return to this question, and shall show, I hope, how we may, by means of dilution or concentration, ensure the removal of certain principles of the blood, either separately, or by a series of analogues.

To sum up, I think I have established by the foregoing:—

1. That there is sugar in the white of a fowl's egg.

2. That white of egg is alkaline, and that the alkalinity is due to carbonate of soda.

3. That the yolk of egg contains no alkali, and that its emulsive property belongs to a product analogous to that of the pancreatic juice.

4. That the yolk of egg is not acid, but becomes so in consequence of an alteration.

5. Heat (by depression), the acid reaction, and the properties of the gastric juice are due to an organic acid, and not to hydrochloric acid.

6. That the alkali and the sugar of white of egg might cause each other to disappear, in the very experiment to demonstrate their existence, and that thus the variance of the results obtained is explained by the difference of the methods.

7. Finally, that the alteration of the albumen of the egg and of all the analogous

matters is so much the more rapid as these matters are more diluted, and that the cause of the greater or less rapidy of this alteration is due, *ceteris paribus*, to the circumstances which favor more or less the solubility of the ferment.

OBSERVATIONS ON THE SUPERSATURATION OF SALINE SOLUTIONS.*

BY H. LŒWEL.

FIRST MEMOIR.

I. THE sulphate of soda crystallised by cooling contains 10 atoms of water when its solution is cooled in contact with the air.

It is known, especially since M. Gay-Lussac's observations on saline solutions, that a solution of sulphate of soda, saturated at the temperature at which it boils, contained in a glass tube empty of air, is capable, on cooling, of attaining, without crystallising, a much higher degree of concentration than if the cooling had taken place in contact with the air. So that there are two degrees of saturation for the same salt, according as the solution made hot is cooled with or without the contact of the air.

In this latter case, it may be said that the solution is supersaturated relatively to the first case.

M. Gay-Lussac observed that if the supersaturated solution, cooled out of contact with the air at the ordinary temperature, crystallises as soon as this contact is given to it, this phenomenon cannot be attributed to the pressure of the atmosphere.

This is the starting point of M. H. Lœwel's experiments.

II. He made three solutions of sulphate of soda with heat; each, formed of 30 grammes of sulphate and 15 grammes of water, was contained in a tube sealed in a lamp.

No. 3 contained platinum wire.

No. 2 sharp fragments of glass.

No. 1 solution alone.

During more than two months that the tubes were exposed to temperatures varying from 59° to 77° F. they deposited nothing, even by agitation.

The temperature having lowered to about 40 or 45° F., crystals were formed, in equal quantity, in the three tubes.

The quantity of crystals proved that their mother liquors were still in the state of supersaturation. Agitation did not increase the mass.

When the temperature of the atmosphere increased, agitation made them disappear; and a return of the lower temperature caused their reproduction.

On breaking the tubes, and decanting the mother liquor into capsules, the following phenomena were observed:—

1. The *crystals* of the tubes touched with a glass rod became opaque throughout their mass, commencing at the point touched: simple contact with the air produced in a long time the same phenomenon.

2. The *mother liquors* decanted into capsules formed a crystalline mass.

The first crystals were sulphate of soda with 8 atoms of water or perhaps with 7 atoms. This salt was noticed by Faraday and M. Ziz.*

The crystals of the mother liquors produced under the influence of the air were ordinary sulphate of soda with 10 atoms of water.

III. M. Lœwel has made many observations on the preparation of sulphate of soda with 8 atoms of water.

This salt crystallises in long prisms with a rhombic base; in becoming opaque by the contact of certain bodies, it becomes warm.

He has ascertained that the mother liquor of these crystals contains, at a given temperature, a definite quantity of sulphate of soda with 8 atoms of water.

It was generally thought that the state of supersaturation of saline solutions was very unstable; since it ceased to exist from causes which seemed to be purely mechanical, such as agitation, or the contact of a chemically inert solid body.

The foregoing experiments show that agitation on one hand, and on the other pieces of glass, and platinum wires, introduced into the supersaturated liquor before cooling, have no influence on the production of crystals.

The electric current determines no change in a solution of sulphate of soda with 8 atoms of water.

A solution of sulphate of soda with 8 atoms, in crystallising, disengages heat, as M. Gay Lussac had observed

Crystallised sulphate of soda with 8 atoms, likewise disengages heat in becoming opaque, as has already been said.

IV. A solution of sulphate of soda saturated by boiling, poured into a capsule, with the contact of the air, becomes covered

Comptes Rendus, No. 7, 18 Feb., 1850.

* These chemists obtained them by leaving boiling concentrated solutions of sulphate of soda to cool tranquilly in covered vessels.

with a pellicle of anhydrous salt, and from 90° to 84° F., it gives crystals with 10 atoms of water, and the pellicle gradually disappears.

When the capsule into which the solution of sulphate of soda saturated by boiling is placed in an atmosphere limited by a bell-glass, in which the air can be renewed only with difficulty, for example, a bell-glass of the capacity of 6 or 8 quarts for a capsule containing one quart of solution, the liquor retains the state of supersaturation on cooling, and crystals are formed only at a temperature below 52° F., and these crystals are the salt with 8 atoms of water.

The solution may remain in the state of supersaturation from 8 to 15 days; so long as it retains this state, neither shocks, vibration, nor agitation cause any crystallisation in it; but when the bell-glass is removed, the liquor becomes a mass, giving crystals with 10 atoms of water.

On putting under the bell-glass anhydrous lime at the temperature of 75° F., the solution gave crystals with 8 atoms of water.

On covering a flask, in which a solution of sulphate of soda has been made saturated by boiling, with a small glass or porcelain capsule, the liquor remains in the state of supersaturation.

In open tubes, of the diameter of 6 to 10 millmetres, the state of saturation is maintained for a long time; that is to say, 3, 4, 6, 8 weeks and more.

V. Agitation does not cause the crystallisation of the sulphate with 10 atoms of water; but a parcel of sulphate of soda determines it, or the simple contact of a glass or metal rod.

M. H. Lœwel has made some very interesting observations on the circumstances of *contact* which can or cannot cause the crystallisation of the sulphate with 10 atoms.

A glass or metal rod, which effects the formation of sulphate of soda with four atoms, when plunged into the supersaturated liquor, loses that property when it has been previously heated to from 104° to 212° F. And if it were not thus, why would the supersaturated solution be preserved in a capsule, in a bell-gless, above the temperature of 46° F.?

A rod of glass or of metal, previously heated to 212° F., retains the property of not effecting crystallisation, even after 10 or 15 days, the temperature varying from 32° to 68° F., if after having adapted a cork to it, and if a flask containing air be closed with this cork, in such a manner that the greater part of the rod be not exposed to the free contact of the atmosphere; for when the rod drawn from the flask has been exposed for a quarter of an hour to the open air, it effects crystallisation.

It is evident then that heat deprives glass and metallic rods of their activity, whilst the contact of the air restores it to them.

12 hours' contact of the rods with water, also deprives them of their activity which they recover in drying by exposure to the open air.

Water does not determine the crystallisation of the supersaturated liquor. Cold alcohol does, but hot alcohol does not.

VI. M. H. Lœwel has been able to produce supersaturated solutions by dissolving sulphate of soda at temperatures not exceeding 26° F.

He has ascertained that the supersaturated solution of sulphate of soda concentrated by evaporation on a glass previously deprived of its activity, gives crystals of salt with 8 atoms of water.

It would seem, says M. Lœwel, that bodies which determine the crystallisation of the sulphate with 10 atoms of water *attract* the crystalline molecules, whilst passive bodies repel them. This would indicate that that the sides of vessels, containing a supersaturated solution should exercise an action opposed to that of the air.

VII. Finally, without the action of the air and of bodies which determine the crystallisation of sulphate of soda with 10 atoms, we have only that with 8 or rather with 7 atoms of water. This proportion of water appears to M. Lœwel more probable than the former.

VIII. M. H. Lœwel has proved that the subcarbonate of soda, potassa alum, chrome alum, &c., present analogous phenomena; but these observations will be the subjects of other memoirs.

ON THE NITRATES OF IRON AND SOME OTHER NITRATES.*

BY JOHN M. ORDWAY,† MASSACHUSETTS.

SESQUINITRATE of iron may be easily obtained in the form of crystals by taking

* Silliman's *Journal*, January, 1850.

† The author observes as follows in a letter relating to his investigations:—

Those who have occasion to prepare liquid nitrate of iron in the large way are often troubled in cold weather by the deposition of crystals before the requisite quantity of

advantage of the fact, that this salt is almost insoluble in cold nitric acid.

When metallic iron is gradually added to nitric acid of spec. grav. 1·29, copious red fumes are given off, and the liquid assumes a greenish hue, till nearly 10 per cent. of iron has been taken up. A further addition changes the color to a dark red; and if the action be continued still longer, a rusty precipitate forms. If we stop short of this last point, and add to the product its own bulk of nitric acid of spec. grav. 1·43, an abundant crop of crystals will be deposited on cooling below 60° F. The same result may be attained by evaporating the greenish liquid, and adding acid enough to insure a considerable excess, before setting the solution aside to cool. If the first crystals are brown, they may be purified by redissolving in nitric acid, with the aid of a gentle heat, and allowing again to crystallize.

The crystals thus obtained have the form of oblique rhombic prisms, which are either colorless or of a delicate lavender color, but when dissolved in water yield a yellowish-brown solution. They are somewhat deliquescent, and very soluble in water; whilst at a temperature below 60° F. a weighed quantity was not wholly taken up by more than 20 parts of nitric acid of spec. grav. 1·37.

At about 117° F. this salt melts into a clear deep red liquid, which in one trial remained fluid till cooled to 83° F., when the heat developed by solidification quickly raised the thermometer to 116·5° F.

The composition of this substance, as indicated below, affords reason for supposing that by its admixture with a bicarbonate an intense cold might be produced. Such proved to be the case, for when 2 oz. of the bruised crystals were stirred up with 1 oz. of pulverulent bicarbonate of ammonia, the thermometer introduced fell from 58° to −5° F. Previous cooling is attended with an increase of effect.

These experiments being very tangible, would furnish excellent illustrations of the principles of latent heat.

A small quantity of the melted nitrate, kept hot for several hours by means of a water-bath, yielded a perfectly dry, dark brown deliquescent powder, containing some water and one-half the original amount of acid. More acid may be expelled by a moderate heat, but to drive off the last portions requires a temperature approaching redness.

The well-drained crystals afforded by precipitation with ammonia 19·8 per cent. of peroxide of iron; and 100 grs. boiled with carbonate of baryta gave a liquor which with sulphuric acid yielded 86·5 grs. of sulphate of baryta, indicating 40·104 per cent of dry nitric acid. Hence the formula is probably $3NO^5$, Fe^2O^3+18HO, which would give in 100 parts,—nitric acid, 40·095; peroxide of iron, 19·819; water, 40·086.

BASIC NITRATES.

A liquid is used in cotton-dyeing, which is prepared by adding iron turnings to aqua-fortis till the solution assumes a very dark red color. A fair sample of this solution, of spec. grav. 1·478, was found by analysis to contain 5 equivs. of nitric acid to 2 equivs. of sesquioxide of iron. A portion of the same, placed in contact with metallic iron, remained clear until nearly enough iron had been taken up to form a sesquibasic nitrate ($2NO^5$, Fe^2O^3), when a rusty precipitate began to appear, whose exact nature it is difficult to determine.

A full sesquibasic nitrate was formed by adding crystals of the nitrate to the proper quantity of freshly-precipitated oxide of iron. And proceeding by the same means, but with slow and cautious steps, as into an unknown region, I was successively astonished by the discovery of soluble basic

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iron has been dissolved. Concerning the true nature of these crystals, I have been unable to gather any definite information from any of the works of chemistry within my reach. Indeed, respecting the compounds of nitric acid and peroxide of iron, though of some importance in the arts, the books give but vague accounts, and those not altogether correct. Thus "azotate ferrique" is described in Hœfer's 'Dictionnaire de Chimie et de Physique' as "d'un brun rouge; *incristallisable*, deliquescent, soluble dans l'eau et dans l'alcool." While Berzelius incidentally mentions that "*Vauquelin* ayant laissé l'acide nitrique en contact avec de la battiture de fer, trouva, au bout de plusieurs mois, des *cristaux incolorés*, qui affectaient la forme de prismes rectangulaires à quatre pans." Perhaps the *rectangulaires* was a mistake, for in several experiments I have obtained forms variously modified, but all referable to the oblique rhombic system. In one huge crystal, which had been many months in forming, the angles included between the long lateral faces of the prism were found to be 101° and 79° nearly.

Numerous experiments made with a view to obtain more light on the subject, have afforded some results which may not be altogether uninteresting, and are, I trust, partly new and singular.

nitrates containing, to 3 equivs. of acid, 2, 3, 6, 8, 12, 15, 18 and 24 equivs. of base respectively; and then, from the slowness with which the union took place in the last, I supposed the limit reached. Yet this liquid was found to bear the addition of a small quantity of lime-water without change.

On arriving at these remarkable results, the question naturally arose, whether there were any chances of error. But on examination no foreign substance was detected; and the analyses of the 6, 12, 15 and 24 basic compounds agreed so nearly with the syntheses as to remove all doubts.

Which of these bodies have claims to be regarded as true atomic compounds, there seems to be no clue but analogy to determine. They all form intensely deep red liquids, which are not altered by dilution nor by brisk boiling provided the evaporation be not carried too far. By spontaneous evaporation they leave a very dark red powder, perfectly soluble in water. That left by the dodecabasic nitrate was not deliquescent, and lost 30 per cent. of its weight by ignition. Hence its empirical composition would be NO^5, $4(Fe^2O^3)+9HO$.

When cotton cloth is dipped in any of these solutions, and dried, the oxide of iron becomes permanently attached. Indeed the adhesion of the base to cotton fibre renders filtration through paper exceedingly slow.

Since spring and river water, and the solutions of most salts, are incompatible with the 24 basic nitrate, it was found necessary to use an abundance of distilled water for washing the oxide used in its preparation. So intense was the color of this liquid, that, though containing only 3·4 per cent. of oxide of iron, 2 drops imparted a perceptible tinge to a pint of distilled water. In trying the reactions of various substances with it, all the iron appeared to be immediately thrown down by muriate of ammonia, chloride of sodium, iodide of potassium, chlorate of potassa, sulphates of soda, lime, zinc and copper, nitrates of potassa and soda, and the acetates of baryta and zinc. Precipitates formed more slowly with the nitrates of ammonia, magnesia, baryta and lead. Tartrate of soda furnished a precipitate soluble in ammonia. Ferrocyanide of potassium gave a dark peat-brown precipitate without the least tinge of blue. Ferrocyanide of potassium likewise gave a rich peat-brown precipitate. Tincture of galls afforded dark brown flakes, and on standing some time the supernatant liquor turned black. Alcohol, acetate of lead, acetate of copper, cyanide of mercury, nitrate of silver and arsenious acid caused no change.

With the tribasic nitrate, muriate of ammonia, chloride of sodium and nitrate of soda produced no effect; while the sulphates threw down all the iron, ferrocyanide of potassium struck a blue color and tincture of galls gave a black.

NITRATE OF ALUMINA.

Nitrate of alumina crystallizes from a concentrated and somewhat acid solution, in colorless, oblique, rhombic prisms, whose length is generally small in proportion to their width. They are deliquescent, and very soluble both in water and in nitric acid. The crystals, like those of the other sesquinitrates, can be best dried by spreading them on an absorbent surface, and placing the whole under a bell-glass with a shallow vessel containing sulphuric acid.

The salt was found to melt at 163° F. into a clear colorless liquid, which began to crystallize when cooled down to 147·5° F, the thermometer rapidly rising at the same time to 162°. The melted mass parts with its acid much less rapidly than the nitrate of iron. 1 oz. of the powdered salt mixed with ½ an oz. of bicarbonate of ammonia lowered the thermometer from 51° to −10° F.

100 grs. of pretty dry crystals yielded by ignition 13·7 grs. of alumina. Distillation with sulphuric acid gave 42 per cent. of nitric acid; and by boiling with carbonate of baryta, 42·42 per cent. was separated. The numbers corresponding to $3NO^5$, Al^2O^3+18HO would be in 100 parts,—nitric acid, 43·17; alumina, 13·68; water, 43·25.

Nitrate of alumina appears to form with the hydrate a series of salts similar to the basic nitrates of iron. But they have not as yet been fully examined.

NITRATE OF CHROME.

Nitrate of chrome crystallizes with difficulty in warm weather; but I have succeeded in obtaining two crops, one of them presenting the form of the oblique rhombic prism, and the other an extremely modified variety of the same. These crystals have the changeable purple color peculiar to the salts of chrome, and their solution in water is of the same hue while cold, but becomes green when heated.

This salt fused at about 98° F. into a deep green fluid, which began to assume the solid state when cooled to 75°, the thermometer rising thereupon to 96°. If heated to redness, it undergoes complete decomposition, leaving a bulky oxide of a beautiful green color.

The composition of nitrate of chrome was found by analysis to be,—nitric acid, 39·7 per cent.; oxide of chrome, 19 per cent. Calculation from the formula $3NO^5$,

$Cr^2\ O^3 + 18HO$ gives,—nitric acid, 40·44; sesquioxide of chrome, 19·13; water, 40·43.

No experiments have been made on the basic salts.

ON THE FUSION AND VOLATILISATION OF BODIES.*

BY M. DESPRETZ.

(Concluded from page 242.)

I HAVE made many experiments with acicular rods uniting the two poles: the results were analagous to those which I have already detailed.

In one experiment, in which the current of the battery united in 24 parallel series of 25 elements each, was passed through a thread of sugar charcoal 4 centimetres in length, and 2·5 millimetres in diameter, it was remarked that the dust of the sugar charcoal, which envelopes the wire in the positive point, in order to render the contact more intimate, collected under the form of a scoria.

In similar circumstances, some globules, aggregated by heat, were perceived amongst the dust; in others, the conversion of this dust into graphite was complete.

M. de Cayeux, member of the Academy of the Fine Arts, M. Barruel, preparator of chemistry to the Faculty of Sciences, and M. Germain Barruel, had no doubt of the dust of sugar charcoal having been fused in this case.

This dust, thus modified by heat, did not tear paper or scratch glass, whilst the charcoal from which it was produced, did both.

It might be expected that a charcoal thread, presented between the two points in the ordinary experiment of the electric light, would attain a sufficiently high temperature to enter into fusion. This experiment was realised a great number of times.

In many experiments, when the light produced by the battery united in six series of 100 elements each, appeared very vivid, a charcoal of 1 millimetre or smaller diameter was gently raised. The extremity of the wire was swelled up and of a black color, and had acquired all the properties of graphite.

A very thick plate of charcoal of essence of turpentine, thus carried into the electrical light appeared to be fused at several parts of the heated extremity. This extremity had assumed the properties of graphite; it traces characters, like that substance; but it does not so readily become bright by rubbing; neither is it so soft to the touch.

We do not regard these last experiments as of great importance, for fear it should be objected that the charcoal, conveyed from the positive to the negative pole, might be arrested by the vertical charcoal. We do not deny that this took place in certain conditions of the experiment, especially when the vertical charcoal rose far enough into the flame; fortunately, we have no need of these experiments for the conclusions which we shall draw further on from our researches.

The experiments which I am about to detail differ in their arrangement, but they lead to the same results.

Small pieces of sugar charcoal, placed in a plumbagine crucible, were subjected to a current of oxygen at the same time as being heated by the battery. After the experiment, the pieces were found welded together and to the crucible: this was evident to myself and to those present.

Another experiment, differing from the last only in the crucible being made of sugar charcoal, gave the same results. The fragments of sugar charcoal penetrated into the crucible; they adhered to it. On upsetting the crucible, nothing fell out.

A small crucible of sugar charcoal, of about 1½ centimetre in diameter, was heated by the battery united in six series of 100 elements each, until it was reduced to scarcely one-third of its bulk. The bottom of the crucible was covered with a mass of globules of a graphite grey.

Another experiment did not give so many globules, but on part of the crucible was found a plate of a blueish graphite grey, as if formed by the reunion of several flattened globules.

The charcoal point which conveyed the light to the crucible, as well as the *point* which strained it, were of sugar charcoal. M. Gaudin, and M. Germain Barruel with the naked eye and with a magnifying glass, and M. de Quatrefages with the naked eye, a magnifying glass and the microscope, examined the products of these two experiments, and all of them saw in them a proof of the fusion of charcoal.

The two crucibles had become softer to the touch, and had the properties of graphite, without, however, so readily becoming bright by friction.

In these experiments, as in all those in which I heated a body in a charcoal crucible, this crucible was always at the positive pole, in order that the phenomenon of transport might not distract the calorific phenomenon.

In one experiment, in which small pieces

* *Comptes Rendus*, No. 25, Dec. 17, 1849.

of sugar charcoal, arranged as we have just said, were strongly heated, we thought we saw two small pieces run together, like two drops of a liquid.

Some experiments were made in the same manner, with this single difference, that the crucible was filled with sugar charcoal in powder. This powder was aggregated in all; but, in one experiment, the powder when strongly heated and aggregated was touched with the point from which the electric light issued. A portion of the powder was attached to the point under the form of scoriæ, and at the part of the crucible touched was a cavity with smooth sides, such as is often seen in metallic residues. A pellicle was also perceived on the edge of the crucible: this pellicle and the cavity were of a blackish grey.

Charcoal of essence of turpentine reduced to a coarse powder, treated like sugar charcoal, united into a mass resembling oxide of iron obtained by the decomposition of water; only its color was deeper.

This experiment, on being repeated, led to the same result; but the mass appeared more deeply penetrated by the heat.

Nearly pure anthracite, in the same condition, was spread on the crucible like black glass. M. Germain Barruel was present at these three experiments; he readily admitted that I had fused the anthracite and the charcoal formed from essence of turpentine.

In an experiment made in nitrogen at the ordinary pressure, and in which I exposed an acicular rod of sugar charcoal to the fire of two points of the same nature held at a distance, the sugar charcoal presented nothing which had not already been observed; but we saw that one of the edges of one of the large points of retort charcoal, to an extent of about the size of a pea, was entirely fused. MM. de Cayeux, Barruel, and Deleuil, jun., agreed in considering the fusion evident. This fused part seemed to me to have lost its softness: I also think that several other products of my experiments are slightly modified by time.

VI. We have detailed an experiment in which anthracite was spread on the crucible under the form of a black glass.

A much larger piece of this substance, treated in the same manner with a battery enfeebled by numerous experiments, was exfoliated. The part which directly received the action of the heat became of a blueish grey: it was well-characterised graphite. The part which was on the edges of the crucible became less hard, but still it was not graphite.

We see that all kinds of charcoal are changed into graphite by the intense heat of the battery. It was natural to seek to know how graphite would act in the same circumstances.

This graphite, known by the name of English graphite, heated until reduced to one-fourth of its bulk was still graphite.

When I made the experiment in which the anthracite was spread on the crucible, I likewise fused graphite.

VII. Although there was no compound of cyanogen in the gas which had been for some time in contact with strongly heated charcoal, I fear that an ephemeral combination was here formed, as happens with the metals, and I substituted carburetted hydrogen for the nitrogen. Here there was no reason to fear combination with the charcoal of the experiment; but another inconvenience presented itself: the carburetted hydrogen deposited charcoal on the thread, and on the whole apparatus. In the few experiments which I made, the thread of charcoal, and the points were covered with lamp black. The lamp black, which was deposited in flakes, being removed, the thread was smooth and of a blueish grey, and had increased in size. There occurred here a phenomenon analogous to the phenomenon observed in the retorts in which lighting gas is prepared.

It appears to me that carburetted hydrogen must be rejected in these experiments; the employment of this gas would lead to errors. Sugar charcoal, which is light black, dull and fragile, would become in the experiments, denser, harder, bright and very solid; we should attribute to the action of heat that which was the result only of a deposit.

I have also made some experiments with oxide of carbon; the results were the same as in nitrogen.

I will also detail some experiments although they were not attended with much success.

I enveloped and impregnated acicular rods of charcoal with more fusible matters, silica, alumina, magnesia, &c., in order to see if the presence of a body fusible by the battery would facilitate the fusion of the charcoal. The silica, alumina and charcoal were dissipated under the form of vapors, and the charcoal remained with all its properties.

I fixed an acicular rod of charcoal in an earthen crucible, I filled this crucible with very dry sand, and I directed the current through the charcoal; it fused and volatilised. I obtained a kind of very hard fulminary tube, the interior of which was

varnished by smoked quartz; the internal diameter of this tube was at least 10 times that of the charcoal.

These last experiments would never have furnished very clear results; the charcoal would always have been mixed with foreign matter.

VII. A Faraday's battery of 100 elements, but larger than the ordinary elements of that battery, sufficed for repeating the experiments on charcoal. I am supposing that it be desired to make only a few experiments, for if a series of investigations be required, it is preferable to employ either Grove's platinum battery, which is the best, or Bunsen's, which is the cheapest.

I bent and volatilised some very fine thread with a Faraday's battery, slightly modified by M. Munke, and constructed by M. Ruhmkorff. His battery consisted of only 60 elements; the breadth of the elements was 45 centimetres, and the height 25 centimetres.

IX. I will close this communication by detailing some experiments which I made on the diamond.

Lavoisier recognised the presence of charcoal in the diamond. The former experiments of Smithson Tennant, Guyton de Morveau, Allen and Pepys, and Davy, and the more recent and more accurate experiments of M. M. Dumas and Stass, [published in the 1st series of the Chemist, vol. I.,] have shown the chemical identity of pure carbon and the diamond.

The Florentine Academicians, encouraged by the Duke of Tuscany, Cosmo III., placed diamonds in the focus of a large burning glass, and saw them dissipate in smoke, without residue.

Lavoisier, in substituting a powerful lens for the burning glass of the Florentine Academicians, proved that the diamond became black and took a more considerable volume.

M. Jacquelain converted the diamond into coke by the fire of a Bunsen's battery of 100 elements. (*Comptes Rendus*, Vol. XXIV, p. 1050.)

I need not dwell on the history of the investigations concerning the diamond: this history has been given in many chemical works.

As I had seen that diamonds suddenly exposed to a high temperature split and scattered, a fact likewise known as regards all the precious stones, I previously heated the diamonds on which I intended to experiment. For that purpose, I confined them in tubes of charcoal of 7 to 8 millimetres in external diameter, closed with charcoal stoppers.

In a *first experiment*, I placed a diamond of about 3 millimetres in diameter in a tube of 23 millimetres between the charcoal points.

The battery was weakened by eight days' use; it was united in six series of 100 each. The tube at first was only feebly reddened, but ultimately became of a white heat. The experiment was stopped at the expiration of 20 minutes. The diamond had become large, and of a greyish black, like graphite; it was a conductor of electricity; it left a trace on paper, like graphite.

Second Experiment.—Same arrangement; diamond of the same size. The experiment lasted only ten minutes.

The diamond retained its color; it still scratched glass; it had not become a conductor of electricity.

Third Experiment.—Heated a second time, in an experiment which lasted seventeen minutes, in which the tube became white hot, it underwent very little alteration; it had not acquired the conducting power.

Fourth Experiment.—A diamond which remained colorless, although heated to a white heat in the third experiment, was placed in a crucible of sugar charcoal; it was heated with the fire of the battery arranged in six series of 100; it swelled up and was heated again; it again swelled up; it adhered to the crucible; it was converted into graphite; like graphite it marked paper; it was a conductor of electricity.

Fifth Experiment.—A smaller diamond immediately heated in a crucible, as in the foregoing experiment, swelled a little, remained round, and immediately acquired all the properties of graphite; it was a conductor.

Sixth Experiment.—A small diamond, treated like the foregoing, split after one or two minutes, and divided into two equal parts, as if it had been cleaved; the exterior was blackish; the portion exposed by breaking remained vitreous, but colored slightly brown. It had acquired conducting power; that is to say, the electricity passed from the part remaining vitreous to the convex surface rendered blackish by heat.

Seventh Experiment.—A diamond of about 2·5 millim. in diameter run immediately like sugar charcoal, before three minutes' heating. The charcoal thus produced from the diamond not only does not scratch glass, but may be crushed between the fingers: it marks paper like graphite, only it is blacker.

Eighth Experiment.—Lamellæ of diamonds were mixed with the dust of sugar

charcoal, and the whole treated as in the last experiments; in a few minutes all was mixed, and had the appearance and the properties of the product of the foregoing experiment.

As the battery was feeble, I took it to pieces, cleaned it, put it together again, and charged it with white nitric acid at 36 degrees.

Ninth Experiment.—I placed six small diamonds in a charcoal tube of 7·3 millim in diameter, and 33 millim in length, between the two points. I arranged the battery in 24 series of 25 elements each. The tube was immediately raised to a dazzling white heat, and I stopped the experiment in 7½ minutes; all the diamonds were already reduced to dust with the exception of two; this dust was soft, and soiled the fingers and paper like graphite.

One of the two diamonds not reduced to dust immediately became bright like well-characterised graphite.

These are the results of this experiment; I conducted it too precipitately, and consequently too imprudently; I should have put the 600 elements in action only successively, and I should thus have retained all my diamonds in nearly their own form.

Tenth Experiment—I put into a crucible of sugar charcoal the diamond dust obtained from strongly calcined diamonds; in this case the battery was united in six series of 100, as in all the experiments made in crucibles. We wish, in experiments of this kind, to throw the flame of the electrical fire on the crucible, then on the matter if it is a conductor. The whole was collected into a mass, leaving small fissures; in these fissures were perceived globules of a blueish gray, similar to those which I obtained with sugar charcoal.

Eleventh Experiment.—In an experiment similar to the foregoing, I only added to the dust of diamond charcoal a diamond reduced to the state of graphite by heat.

At the middle of the bottom of the retort was a dull, black, homogeneous mass. Between this small mass and the crucible, was a space filled with globules of the color of graphite, like crystals filling a geode.

Thus the diamond becomes, by intense heat, charcoal, a conductor, and almost immediately graphite. If the heat is sustained, it gives rise to small fused globules, like those furnished by charcoal.

MM. Quatrefages and Germain Barruel examined these last two crucibles, and likewise admitted the existence of the globules.

X. It will be perceived that when I speak of fused globules I do not mean those vitreous globules, often translucid, sometimes colorless, but almost always of a black color, to which impure anthracite and graphite, and most sorts of retort charcoal give rise, when submitted to the heat of the battery, of a powerful lens, or even of a large blow-pipe. Many of these globules are attractable by the magnet. This is proto-silicate of iron; others are earthy silicates. They are never obtained with pure sugar charcoal, charcoal of essence of turpentine or the diamond, and very rarely with very pure anthracite.

XI. To sum up, it follows from the communication of the 16th of July, and from that which I now make, that:—

1. Charcoal in vacuo is evidently reduced to vapor at the temperature which it acquires from a Bunsen's battery of 500 to 600 elements, united in 5 or 6 series. In a gas it is slower, but it is likewise accomplished.

2. Charcoal raised to the temperature obtained in our experiments, may be bent, welded and fused.

3. Any kind of charcoal becomes so much the harder as it is submitted for a long time to a high temperature. In fact, it is converted into graphite.

4. Pure graphite is gradually dissipated by heat, like charcoal. The part not volatilised is still graphite.

5. The diamond is changed, by the heat of a sufficiently powerful battery, into graphite, like every kind of charcoal. Like charcoal, it gives rise to small fused globules, when heated for a very long time.

6. If we compare the results of our experiments with the production of graphite in the high furnaces, from the hexahedral form of natural graphite, a form incompatible with the regular octohedron, we are induced to think that the diamond is not the product of the action of an intense heat on the organic or carbonaceous matters.*

EXAMINATION OF THE LIQUID FROM A CASE OF OVARIAN DROPSY.†

BY THORNTON J. HERAPATH, ESQ., BRISTOL.

For the specimen of fluid which I have examined, I am indebted to my brother,

* Sir David Brewster, (Proceedings of the Geological Society of London, No. 31, 1833), from the examination of some diamonds, in the interior of which he found cavities filled with gas, was led to think that the diamond has a vegetable origin; that it was originally in a soft state, and that it hardens in the same manner as a gum.

† *Chemical Gazette*, March 1st, 1850.

Dr. William Bird Herapath, who removed it, on the 22nd of last November, by paracentesis abdominis, from the cavity of the ovarian cyst of a female patient. The quantity so obtained amounted to about five and a half gallons.

It was of a light reddish-brown color, somewhat viscid, and frothed when agitated. It possessed a rather unpleasant odor, and a slightly salt taste. The specific gravity at 61° F. was 1·011. It exerted a very marked alkaline reaction on turmeric and reddened litmus-paper, from the presence of carbonate of soda or potassa. Under the microscope there were exhibited a few corpuscules, which were somewhat similar in appearance to blood-discs, but more granulated. They were most probably imperfect, or perhaps altered blood-globules. No pus could be detected.

When allowed to remain undisturbed for a short time, a thin web of fibrine was gradually deposited. On being heated it became opaque, and and finally transformed into a thick tremulous mass, from the coagulation of the albumen. The same effects were produced by the addition either of sulphuric, hydrochloric or nitric acid, especially with the latter. Acetic acid caused a slight precipitate, which was insoluble in excess; and this was greatly increased upon the further addition of ferrocyanide of potassium. Infusion of galls occasioned a bulky grayish precipitate, which was not redissolved upon boiling. In the fresh liquid, bichloride of mercury produced an abundant precipitate; but after boiling and filtering, it was but slightly affected by this reagent. Heated with a few drops of a solution of potassa or soda, it gave off a very evident ammoniacal odor, arising from the decomposition of the urea. On incinerating the dried residue that remained after evaporation, an ash was obtained which was almost entirely soluble in water. The solution was highly alkaline, from the presence of carbonate of soda; it likewise contained chlorine and small quantities of phosphoric and sulphuric acids with potassa. The insoluble salts were chiefly composed of the carbonates and phosphates of lime and magnesia, with a minute proportion of perphosphate of iron and silica.

I. QUANTITATIVE PROXIMATE ANALYSIS.

1106·04 grs. of the fresh liquid were carefully evaporated to dryness at a steam-heat; the residue weighed 37·24 grs. This was then repeatedly extracted with a boiling mixture of alcohol and ether; the residue again dried, etc., and the loss noted; it amounted to 5·63 grs.

The alcoholic solution was evaporated to dryness, and treated several times successively with boiling ether, which removed 0·565 gr. of fatty matters and lactates or lactic acid. The presence of lactic acid in this solution was proved by again evaporating to dryness, redissolving in water, and boiling the aqueous solution thus obtained with oxide of zinc, when by concentration a salt was obtained which was perfectly similar in character to the lactate of zinc prepared from muscular flesh.*

That portion of the alcoholic extract which was insoluble in ether, was principally composed of urea and a peculiar extractive matter, mixed with a small quantity, (0·21 gr.) of inorganic salts (chloride of sodium principally, with a little carbonate of soda and phosphate of potassa).

The substances that were left undissolved by the boiling alcohol were then reduced to a fine powder, and repeatedly treated with boiling water. This menstruum extracted the gelatine and mucus (?) together with the residuary soluble inorganic salts. This aqueous solution was not rendered turbid either by boiling or the addition of nitric acid; but it nevertheless contained albumen in combination with soda.† To estimate the former, the solution was concentrated to the consistence of a syrup, and connected by means of two platinum electrodes with a small galvanic battery, when the albuminate of soda was decomposed, and the albumen attracted by the positive pole, whence it was carefully detached and weighed. The residuary matters were afterwards incinerated, and the weight of ash noted; it amounted to 8·42 grs.

The insoluble albuminous residue, after extraction by water, alcohol and ether, was found to weigh 22·380 grs., and when burnt left 0·44 gr. of an ash composed of the earthy phosphates and carbonates.

In order to determine the true amount of urea contained in this liquid, I had recourse to a modification of Lassaigne's process,

* 2·99 grs. of the salt, dried at 212° F., gave 0·998 grs. of oxide of zinc=33·38 per cent. This agrees very well with the composition attributed by Dr. Heintz to the combination of ozide of zinc with the lactic acid of muscular flesh, viz., $C^6H^5O^5$, ZnO +2HO, which would require 33·33 per cent. of ZnO. Unfortunately want of material prevented me from further establishing their identity by an ultimate analysis.

† The same remarks, I may observe, have been made by Dr. Wright with regard to the salivary juices. Indeed it was from the perusal of that gentleman's paper on this subject that the idea was first suggested to my mind of decomposing the albuminate of soda by means of galvanism.

which I have already described in a paper on the examination of the choleraic fluids.* 1106·04 grs. gave 8·875 grs. of pernitrate of urea=4·656 grs. of urea.

I likewise succeeded in detecting the presence of an exceedingly small proportion of uric acid, but the quantity was too minute to be estimated. No kreatinine, sugar or succinic acid could be discovered. I was induced to look for the latter in consequence of the publication of a paper by Dr. W. Heintz† in which that chemist states that he has detected succinate of soda to the amount of nearly 0·5 per cent. in the liquid of hydatid cysts, which he examined, from the liver of a woman.

II. INORGANIC CONSTITUENTS.

The dried matters resulting from the evaporation of a similar quantity (1106·04 grs.) of the fluid were incinerated, with the necessary precautions, in a covered platinum crucible; they left 9·29 grs. of ashes. Of these water extracted 8·60 grs., which, when analysed by the ordinary methods, gave of—

	grs.
Carbonic adid	0·4400
Sulphate of baryta, 0·02 gr.=SO^3	0·0067
Phosphoric acid	0·2774
Chloride of silver, 16·46 grs.=Cl	4·1150
Mixed chlorides of potassium and sodium	8·644
Potassio-chloride of platinum, 1·634 gr.=KaCl	0·5866
Chloride of sodium (by loss)	8·0580

quantities which are equivalent to—

Carbonate of soda	1·0800
Sulphate of potassa	0·0147
Phosphate of potassa, 2 KaO, PO^5	0·6473
Chloride of sodium	0·8580

The insoluble salts weighed 0.69 gr., and furnished of—

	gr.
Carbonic acid	0.062
Sulphuric acid	traces
Phosphoric acid	0·166‡
Phosphates of iron and alumina, slight traces	
Silica	slight traces
Carbonate of lime, 0·605=CaO	0·374
Pyrophosphate of magnesia, 0.060=MgO	0·024
Carbonacous matters	0·200

that is to say of—

Carbonate of lime	0·0800
Carbonate of magnesia	0·0500
Phosphate of lime, 3 CaO, PO^5	0·3600
Phosphates of iron and alumina	traces
Sulphate of lime	traces
Silica	traces
Carbonaceous matters	0·2000

From these experiments, therefore, it appears that 1106·04 grs. of this fluid contained of—

	per 1000 grs.	
Fibrine	0·9980	=0·9024
Albumen	21·9400	19·8372
Fatty matters & lactic acid, or alkaline lactates	0·5650	0.5108
Urea	4·3560	4·2027
Uric acid	traces	traces
Extractive matters, soluble in alcohol but insoluble in ether	0·1990	0·1798
Gelatine, with some mucus and extractive matters	0·4871	0·4404
Albumen with soda	0·3229	0·2919
Ash. Carbonate of soda	1·0600	0·9764
Ash. Sulphate of potassa	0·0147	0·0132
Ash. Phosphate of potassa, 2KaO, PO^5	0·6473	0·5852
Ash. Chloride of sodium	6·8580	6·2008
Ash. Carbonate of lime	0·0800	0·0723
Ash. Carbonate of magnesia	0·0500	0·0452
Ash. Phosphate of lime, 3CaO, PO^5	0·3600	0·3254
Ash. Phosphates of iron and alumina	traces	
Ash. Sulphate of lime	traces	
Ash. Silica	traces	
Water and loss	1067·7820	965·4093
	1106·0400	1000·0000

Medical Gazette, No. 1146, Nov. 16, 1849.

† Jenaïsche Annalen für Physiologie und Medicin.

‡ This was estimated by precipitating the acetic acid solution of the earthy phosphates by sub-acetate of lead, and decomposing the phosphate of lead so produced by sulphuric acid. The numbers were as follows:—3PbO, PO^5, 0·913 gr. gave of PbO, SO^3, 1·023 gr.=PbO 0·747. Therefore 0·913 minus 0·747=0·166 PO^5.

ON THE PRODUCTS OF THE DECOMPOSITION OF HYDRO-SULPHURIC AND SULPHUROUS ACIDS IN WATER.*

BY SIGNORI SOBRERO AND SELMI.

WHEN sulphurous acid and hydrosulphuric acid (sulphuretted hydrogen) are passed at the same time into a flask filled with distilled water, the two gases dissolve and are reciprocally decomposed, depositing sulphur. At the same time (and this is a known fact), the liquid acquires a very distinct acid reaction, and assumes a yellow color, dissolving sulphur. It is known that Wackenröder has found, as a product of this reaction,

* Extract of a Memoir read before the Academy of Sciences at Turin, 11 June, 1849.

pentathyonic acid. That chemist passed hydrosulphuric acid gas into water previously saturated with sulphurous acid; he afterwards saturated with carbonate of baryta, in order to precipitate the salt by means of absolute alcohol. It appeared to us interesting to ascertain whether among the acids of the thyonic series, pentathyonic acid alone can be formed in the above-mentioned reaction. For that purpose, we modified Wackenröder's process, by passing both gases at the same time, and for several days continuously, into a flask nearly full of distilled water; in this manner, we were enabled to obtain very concentrated acid liquors, in which we should be able to recognize the different acids formed in it, which would not have been possible with very weak products, such as must have been obtained by M. Wackenröder's process. We therefore established our apparatus, and when the operation had been in train for several hours, we from time to time removed from the receiver a certain quantity of liquid, which we saturated with carbonate of baryta. The barytic solution was filtered and poured into rather weak alcohol to separate the hyposulphite of baryta, if any had been formed and dissolved, and then into very strong alcohol. We afterwards analysed the salt deposited from this liquid. It is very certain that, by this means, we should always have obtained the same analytical data, if the reaction of the two gases gave only pentathyonic acid. But experiment has proved to us that the results are very variable. We have, indeed, often obtained salts which gave a composition shewing them to be mixtures of pentathyonate and tetrathyonate of baryta. Sometimes we met with the tetrathyonate giving by analysis the numbers attributed to that salt by MM. Fordos and Gélis. Indeed, we found in it:—

			Fordos and Gélis.
Baryta	38·74	38·65	38·50
Sulphur	32·83	32·68	32·25
Oxygen combined with the sulphur	19·81	19·55	20·16
Water	9·12	9·12	9·09

Several times, having precipitated by strong alcohol the acid liquid saturated with carbonate of baryta, and having placed the liquid rendered clear by repose in an imperfectly closed vessel, we obtained, by slow evaporation, prismatic crystals retaining a little alcohol notwithstanding their desiccation, and in which the proportion between the baryta and the sulphur was as 1 equivalent of the former to 4½ equivalents of the latter, or else as 2 equivalents to 9 equivalents, the composition of the tetrapentathyonate of baryta of Ludwig. We have also met with among the products of the decomposition of sulphurous acid and hydrosulphuric acid, pentathyonic acid, hyposulphurous and sulphuric acid; we never found M. Langlois' acid. It would be important to be able to determine in what circumstances one or other of the acids mentioned is formed in preference; certainly the difference of the products should depend on the relative proportion of the two gases, and, moreover, on the concentration of the liquid in which they are decomposed, and on the temperature. We have no positive data in this respect.

The liquid in which the sulphurous and hydrosulphuric acids are decomposed, gives a very abundant precipitate of sulphur; it retains itself much sulphur, which separates from it as often as it is saturated by a carbonate or by an energetic base, potassa, soda, &c. The sulphur deposited during the decomposition of the gases is always of a fine yellow color, but sometimes opaque, and sometimes diaphanous or almost transparent. Separated from the liquid by decantation, it has a powerful acid reaction; if water be added to it, it divides in it, forming an emulsion from which it does not separate even by very long standing (several months). If it be diluted in much water, it gives an almost transparent liquid. If a small quantity of an aqueous solution of a neutral salt of potassa or soda be added to the emulsion of this sulphur, a precipitate of sulphur is immediately obtained; but, which is a singular thing, if a salt of soda has been employed for the precipitation, the sulphur has not lost the property of dividing in water. To ascertain this, it is sufficient to decant the liquid containing the salt of soda, and to wash the precipitate several times with distilled water: at the second or third washing, the sulphur no longer deposits; it regenerates the emulsion. If, on the contrary, a salt of potassa, especially the sulphate, has been employed, the sulphur precipitated has completely lost the property of forming an emulsion in water. It has acquired a pasty consistence, becomes gluey, and is elastic like caoutchouc, and resists washings repeated for an indefinite number of times, without losing this very peculiar condition. This sulphur obstinately retains a certain quantity of the acid in the midst of which it is precipitated; it immediately loses its elasticity by the action of the alkaline carbonates or caustic alkalies. The sulphur capable of forming an emulsion loses this property when exposed for a long time to the air; it becames pulverulent. The elastic sulphur, precipitated by sul-

phate of potassa, retains its elasticity, notwithstanding its exposure to the air; we have some which was prepared several months ago, and which has not lost any of that property. We have ascertained, moreover, that, despite repeated washing, it still retains a little of the sulphate of potassa used for precipitation. We have said that the acid liquid, produced by the decomposition of the two gases, retains much sulphur. To convince oneself of this, it suffices to add to it a little of a neutral salt of soda or potassa. We have had liquids marking 17 or 18 degrees of the areometer, which took the form of a mass on the addition of a small dose of the salts mentioned. This enormous quantity of sulphur must be said to be dissolved, for it does not alter the limpidness of the liquid. The precipitate obtained in this case presents the same differences and the same phenomena, as regards its susceptibility of forming an emulsion, or of being elastic and not capable of forming an emulsion, which we have noticed in the sulphur precipitated during the decomposition of the two gases. Sulphur may therefore be modified in its condition, in a very peculiar manner, by the presence of bodies in the midst of which it is deposited, and which obstinately adhere to it, probably by simple adhesion, and acquire, sometimes a capability of forming an emulsion, and sometimes a state of aggregation which prevents it from dividing in water. It results, moreover, that emulsionable sulphur presents phenomena analagous to those which are observed in many other bodies which possess the property of being dispersed and divided in a liquid, without, however, being absolutely dissolved in it, such as soap, starch, and Prussian blue, on which one of us, Signor Selmi, has already made observations analagous to those which we have just made. These facts belong to an order of phenomena which Signor Selmi has well characterised, and which he has collected under the name of *pseudosolutions*. It appears that the number of *pseudosoluble* bodies is very great. We have already undertaken some investigations on this point; bodies of organic nature especially appear to us to present great interest in this point of view.

METHOD OF PURIFYING NAPHTHA FROM A CERTAIN VOLATILE OIL.

To the Editors of The Chemist.

GENTLEMEN—Having occasion to make a solution of bichloride of copper in naphtha, I was very much surprised to find a thin stratum of volatile oil floating on the surface; the solution was made in a two-ounce phial, and the thickness of the film was about $\frac{1}{20}$th of an inch. On examination, I found it to be soluble in alcohol, naphtha, ether and oils; it burnt with a murky flame like that of turpentine; it seemed to be pretty volatile, but I did not ascertain its boiling point; its odor resembled that of ordinary naphtha, but was much stronger, more nauseous and sickly.

It would be highly interesting to carefully examine this body, and decide whether it be one of the compounds usually associated with wood spirit, or if it be some hitherto undiscovered substance.

It is not at all unlikely but that the disagreeable odor peculiar to naphtha may arise from the presence of this volatile oil, and it is just as probable that the injurious effects of the vapor of naphtha upon the eyes of French-polishers, &c., may spring from the same cause.

I have tried several of the muriates, but could not obtain by them any separation of the volatile oil—none appeared to answer but the cuprous salt.

In conclusion, the above method presents a capital means of isolating the volatile oil, whatever may happen to be its constitution and nature. The expense attending the purification of the naptha is next to nothing, for the salt of copper will serve over and over again; it may be procured by double decomposition from common sulphate of copper, and chloride of calcium—both materials being extremely cheap.

I should think that common salt might be substituted for chloride of calcium, if the latter cannot be easily had.

I have the honor to be,
Yours truly,
T. W. N.

ON THE ACTION OF GLUCOSE AND SULPHURIC ACID ON ORGANIC SUBSTANCES.*

BY M. SCHULTZE.

IT is known that M. Pettenkofer has pointed out a very curious reaction for detecting bile. He mixes this liquid with a certain quantity of sulphuric acid, and then adds a few drops of a concentrated solution of glucose; when this mixture is gently heated, so as not to

* *Annalen der Chemie und Pharmacie*, vol. lxxi. p. 266.

exceed 122° F., it very soon assumes a magnificent purple color.

It was believed that this reaction was peculiar to the bile, and that, consequently, it might be used to distinquish that fluid. In physiological and microscopical studies of the lower animals, it had been applied to the investigation of the organs intended for the secretion of bile. It results from M. Schultze's researches that we have gone too far in these conclusions. The reaction indicated by M. Pettenkofer is by no means peculiar to the bile. It is easy to produce it with a great number of other organic substances, and particularly with the albuminoïd tissues, matters analogous to horn, and even the liquid portion of the fat (elain). The author operated in the following manner, in order to observe under the microscope the color which these various matters develope in contact with sulphuric acid and glucose. The tissue to be examined is laid on a piece of glass, in a drop of a moderately concentrated solution of glucose; one or two drops of sulphuric acid are then added; this acid is either put immediately on the tissue, or, as is preferred in most cases, on the edge of the drop of glucose. In operating on albumenoïd substances, we obtain, in the first case after a few seconds, and in the second case, after a rather longer time, a red coloration, which gradually becomes violet. The fibres of the muscles and of the nerves, well washed with water, acquire this color with the greatest ease. It is the same with the crystalline lens. The fibres of the tendons, on the contrary, the cellular and serous membranes, freed by washing with water from the the albumenoïd matter with which they are impregnated, act in a different manner: they do not become red, but of a brownish yellow. The gelatinous tissue of the bones is colored in the same manner; the fibre of the elastic tissue freed by boiling with water from the fibres of the cellular tissues, are not altered when heated with glucose and sulphuric acid.

Drops of elain extracted from the spinal marrow were colored red.

The cartilaginous tissues acted in a peculiar manner: the cartilaginous substance was colored of a reddish yellow, whilst the cartilaginous cellules themselves were colored red.

The corpuscules of the blood, mucus, and pus, were likewise colored red.

Finally, matters analogous to horn, as the epidermis and epithelium, the hair, feathers, horn itself, whalebone, and serpents' scales, are colored red.

ON CHLORIDE OF CYANOGEN AND TITANIUM.*

BY F. WÖHLER.

In a previous paper, the author observed that the chloride of titanium formed with chloride of cyanogen a definite compound. But for its existence, the cubic crystals of titanium might have long continued to be regarded as the pure metal. It was this compound which, owing to its volatile nature and its power of crystallising, showed the presence of cyanogen in them. It was, therefore, interesting to quantitatively ascertain its composition.

Chloride of cyanogen and titanium is instantaneously produced, with a powerful disengagement of heat, by passing gaseous chloride of cyanogen into chloride of titanium. The latter is speedily converted into a loose, yellow, crystalline mass.

This double chloride is of a lemon yellow color and extremely volatile. It commences to volatilise much below the boiling point of water, and sublimes in transparent lemon yellow crystals, which seem to be rhombic octohedra. It gives off fumes powerfully in a damp atmosphere, and becomes of a milky white, evolving the pungent odor of chloride of cyanogen. Water dissolves it, forming a perfectly clear solution, with an evolution of intense heat and gaseous chloride of cyanogen. It is soluble in warm chloride of titanium, from which it separates again in crystals, by cooling. It absorbs ammoniacal gas with considerable evolution of heat, forming with it a deep orange-red compound, which also turns white in a humid atmosphere, and dissolves in water with a partial separation of titanic acid.

Chloride of cyanogen and titanium is represented by the formula $CyCl+2\,TiCl^2$, according to which it should contain 75·56 of chloride of titanium per cent.

3·008 grammes were dissolved in water and, while boiling, precipitated by ammonia. 0·964 grammes of calcined titanic acid, corresponding to 2·283 grammes or 75·89 per cent., was obtained.

ON THE OIL OF ELEMI.†

BY M. H. DEVILLE.

The author states that M. de Bonastre subjected the resin of elemi to distillation with water and obtained an oily principle, respecting which he merely stated that it had been produced.

* *Göttingen Nachrichten*, January, 1850.

† *Annales de Chimie et de Physique*, Sept. 1849, and *Phil. Mag.*, March, 1850.

Some time since Dr. Stenhouse published a series of experiments on the oils of olibanum and elemi.

There are several varieties of elemi which differ from each other in consistence and in the quantity of ligneous matter accidentally and intimately intermixed. This resin is sometimes as soft as thick honey, and at other times solid and hard, according to the degree of alteration which it has undergone by exposure to the air. It will therefore be readily conceived that the quantities of oil of elemi produced by distilling the resin may vary very considerably, as proved by the numbers of Dr. Stenhouse, M. de Bonastre, and the author. Some specimens of elemi of good quality yielded M. Deville more than 13 per cent. of oil.

After the usual purifications, which are very readily effected, the oil is a colorless liquid of great limpidity and fluidity, and of a pleasant odor; its density at about 52° F. is 0·849; its mean index of refraction is 1·4719 at 56°; that is to say, it is the same as that of oil of turpentine and the greater number of its isomeric compounds. Its rotary power is 90° 30′: it is consequently one of the substances which turn most strongly to the left.

Its boiling point is remarkably constant (which, the author remarks, is not the case with all essential oils); it is about 345° F. under a pressure of 755 millimetres. M. Deville, like Dr. Stenhouse, found the oil of elemi to be similar in composition to the oils of turpentine, lemons, etc.:

	I.	II.		
Hydrogen	11·9	11·9	11·76	$C^{20}H^{16}$
Carbon ..	88·0	88·1	11·76	
Loss	1			
	100·0	100·0		

The density of the vapor was found to be the same as that of oil of turpentine; by experiment, it was 4·84; calculation gives 4·76. Contrary to the observation of Dr. Stenhouse, the author was able to obtain two camphors from elemi, one of which is solid and crystalline, and the other liquid. Both have the same composition, and are isomeric with the camphors of lemon. The following are the author's analyses:—

	Experiment.			Calculation ($C^{16}H^{8}$, HCl)
Carbon ..	57·3	57·3	57·5	57·4
Hydrogen	8·7	8·7	8·7	8·6
Chlorine .	34·0	34·0	33·8	34·0
	100·0	100·0	100·0	100·0

The quantity of hydrochloric acid absorbed by oil of elemi is considerable, amounting to 47·7 per cent. of the weight of the oil; and in order to obtain the crystallised camphor, the current of gas must be continued long after the period at which the saturation appears to be complete. The matter is then liquid, but the solid camphor is readily deposited after the excess of acid has escaped by exposure to the air. The rotation of this camphor is nil, like that of its isomer, camphor of lemons.

METHOD OF SEPARATING SILVER FROM CUPREOUS SOLUTIONS.*

BY M. BOLLEY.

The author mixes the solution with cane sugar and potassa or ammonia, boils and extracts any precipitated oxide or protoxide of copper with acetic acid. The silver is obtained in this operation as a mirror, and sometimes also in the form of a powder.

CHEMICAL EXAMINATION OF MADDER.†

BY M. DEBUS.

M. Debus has arrived at different results in his investigation of this coloring matter, from those obtained by Schiel and Schunck. The madder root was boiled two or three times with fifteen or twenty times its bulk of water, and the solution having been filtered through flannel, was heated for a considerable time with hydrated oxide of lead. A portion of the lead is then dissolved, and a part forms insoluble reddish brown compounds with the coloring matter; the liquid extract acquires a clear yellow color, and no longer precipitates the salts of the metallic oxides. The lead precipitate, having been carefully washed, was decomposed with warm dilute sulphuric acid, when the coloring matter accompanied the sulphate of lead, and could be freed from acid by simply washing with water. On boiling this mixture several times with alcohol, the greater portion of the coloring matter is dissolved, a dark brown body remaining in an insoluble combination with the sulphate of lead. The substances held in solution by the alcohol may be divided into two groups, the one of which is precipitable by calcined oxide of zinc, whilst those of the other group remain in solution. Of these latter the author gives no account at present. To obtain the former the solution is treated with oxide of zinc as long as the oxide acquires a red color, and heat is applied to ebullition, to cause the

* *Jahrbuch für praktische Chemie*, and *Chem. Gaz.*

† *Patent Journal*, March 16th, 1850.

more rapid deposition of the compounds produced. The precipitate, after being washed with alcohol, is decomposed with sulphuric acid, which dissolves the oxide of zinc, leaving the coloring matter; the latter is purified by solution in ether, reprecipitation with oxide of zinc, and a second decomposition with sulphuric acid. The washed and purified coloring principles are then boiled with a strong solution of alum, until the alum solution deposits no solid matter when cold. The first and second portions of the solution of alum deposit a brown-red substance on cooling, which in the subsequent portions is replaced by a pure yellow deposit. This yellow body is treated with dilute hydrochloric acid, to remove the alumina which it contains, and is then obtained in beautiful yellowish-red needles, after repeated crystallisations from alcohol. The crystalline substance possesses acid properties, and is called by the author *lizaric acid*. The solution of alum, from which the lizaric acid has separated, is still of a deep red color, and when treated with sulphuric acid deposits, after some time, another body, which may likewise be purified by solution in hot alcohol, from which solvent it crystallises in the cold. This latter substance is also an acid, occurring in long red needles, and is called by Debus *oxylizaric acid*.

The yellow liquid, from which the coloring matters and the oxide of lead were separated, yielded several bodies, the nature of which the author has not been able to ascertain positively.

Lizaric acid is identical in composition and properties with the alizarin of Schunck. Its composition is expressed by the formula $C^{30}H^{10}O^{9}$ and its lead salt by $C^{30}H^{8}O^{7}2PbO$. The composition of oxylizaric acid is expressed by $C^{15}H^{5}O^{5}$ and its lead salt by $C^{15}H^{8}O^{4}PbO$.

An equivalent of lizaric acid, with one equivalent of oxygen, therefore affords two equivalents of oxylizaric acid. The madder red and the purple, which have been prepared by Schiel, according to Runge's process, when analysed, yield lizaric and oxylizaric acids on treating their solutions in alcohol, with oxide of zinc.

ON SOME OF THE POLYBASIC SULPHATES OF THE MAGNESIAN SERIES.*

BY M. SCHŒUFFELE.

THIS is the title of a work which M. Schœuffele has just presented to the faculty of sciences at Besançon to obtain the degree of doctor of sciences.

This work, by proving the fact first announced by M. Gerhardt, that it is not indifferent, in the precipitation of one solution by another, whether the first liquid be poured into the second or the second into the first, makes a step in the wide study of the double salts, and furnishes new examples of isomorphism.

The experiments of M Schœuffele, in the account of which we easily trace the hand of a skilful and experienced practitioner, lead to the following conclusions:—

1. By treating a saturated solution of sulphate of zinc with sulphate of magnesia, we obtain a different product from that which is formed by proceeding in the inverse manner.

2. It is the same if the sulphate of magnesia is replaced by sulphate of iron.

3. It follows that if a saturated solution of sulphate of magnesia is still susceptible of solution by sulphate of zinc, it is not only in consequence of its tendency to form a double combination, but because this phenomenon is complicated with the *influence or effect of masses*, in the same manner that in double decompositions we obtain different products, according to which liquid we employ in excess.

4. By placing the sulphates of zinc, magnesia and iron in the conditions just indicated, we obtain double salts of iron and zinc, magnesia and zinc, each containing seven atoms of water, but being divided with respect to its crystalline form, into two types:—

A. The sulphate of iron type, $SO^{3}\left\{\begin{matrix}FeO\\ZnO\end{matrix}\right\}+7HO$, which comprehends different sulphates of iron and of zinc examined by the author and the two principal of which he has designated by the formula

$$SO^{3}\left\{\begin{matrix}FeO\\ZnO\end{matrix}\right\}+7HO$$

B. The sulphate of zinc type, $SO^{3}ZnO+7HO$, which contains a double salt described by M. J. Pierre, as well as the one obtained by M. Schœuffele, which salts the latter has designated by means of the formula

$$SO^{3}\left\{\begin{matrix}ZnO\\MgO\end{matrix}\right\}+7HO.$$

5. There is a sulphate of the type x, containing three bases: namely, protoxide of iron, oxide of zinc and magnesia. This salt is analagous to the Saltzburg vitriols, studied by M. Lefort. The sulphate of copper in these, is replaced in M. Schœuffele's salt, by sulphate of magnesia. These two vitriols also contain, one sulphate of zinc, the other sulphate of iron, whereas the triple sulphate contains *both* these salts as well as sulphate of magnesia.

* *Journal de Chimie Médicale*, Mar., 1850.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

ON THE NECESSITY OF ALLOWING THE USE OF ALCOHOL IN MANUFACTURES FREE OF DUTY.

Now that the Chancellor of the Exchequer has a considerable surplus of revenue, it may not be amiss to make some observations on the injurious effects of the spirit duties on some manufactures. We do not for one moment expect that Sir Charles Wood will give up his intention of removing the tax from bricks and lowering the stamp duties on the transfer of landed property; but we cannot allow the opportunity of so prosperous a condition of the Imperial treasury to pass by without making our claim on behalf of the manufacture of articles in the producton of which large quantities of alcohol are employed.

Another motive also actuates us—next year, the manufacturers of England are to compare their productions with those of foreign nations. It is very probable that many chemical manufacturers will exhibit specimens of their skill; but in those cases in which they require the use of alcohol, they will not fare so well as the foreigner who has always had that liquid at a very trifling cost.

It would be difficult to name an article the duty on which is productive of so much injury to science and industry as the duty on spirit.

Alcohol is a most important instrument in the hands of the organic chemist, being the agent by means of which he separates the various proximate principles of the vegetable kingdom, and which enables him to furnish the medical profession with those active principles on which the medicinal properties of vegetable medicines depend. On the present occasion, however, it is not our intention to dwell on this portion of the subject, but, to consider those bodies which owe their origin to alcohol, commencing with chloroform.

It is calculated by manufacturers that one gallon of alcohol of sp. gr. ·830 to ·840 will produce lbs2½ of chloroform (some obtain a little more.) This gallon of spirit costs about 17s. 6d.—of which about 10s. is for duty. The lbs2½ will not sell for more than 17s.—less than the cost of the spirit, and allowing nothing for the expense of chloride of lime and labor.

The reason that chloroform is sold in our market at a lower price than it can be made for here, is, that in Scotland the duty on alcohol is very considerably lower than in England, and that there is no duty on chloroform brought from that country to this. The Scottish manufacturer is thus enabled to undersell the English in his own market. The duty charged on alcohol amounts to about 4s. per pound on the chloroform produced from it, or nearly two-thirds of its value; the effect of this state of things is, that the manufacturer has endeavored to employ substitutes for alcohol in the manufacture of chloroform, and chloroform so produced is occasionally met with in the market. Every one acquainted with the subject must admit that chloroform made from such a substitute as pyroxylic spirit is less safe for employment in medical practice, and is at any rate far more disagreeable than that which is prepared from alcohol. It has been alleged that the injurious effects which have followed the use of chloroform as an anæsthetic agent, have been traced to the fact of its having been prepared with pyroxylic spirit.

From the peculiar qualities of chloroform—its powerful solvent properties on certain gums, and the ease with which it volatilises, there is no doubt that if it could be produced at a moderate price, it would soon be applied to a variety of useful purposes

in the arts; but under existing circumstances the honor and profit of such application are left to other nations where genius is less fettered by fiscal regulations.

We wish to impress on the public mind that the duty on alcohol acts as a prohibition to its use in industrial pursuits; that it would be matter of policy in the Government to place the English Manufacturer on an equality with the foreigner, and that the Imperial coffers are not enriched by the enforcement of this tax, which inflicts such severe injury on the industrious classes.

It should be the earnest desire of the legislature to raise the means required for conducting the business of the State by taxes which do not interfere with the nation's industry, and to amend or entirely remove them when found to obstruct it.

It is very true that in the instance of chloroform, we deal with Scotland; but there are many cases in which we are obliged to send to foreign countries for those articles in which alcohol performs an important part, and in which we might enjoy a considerable trade of our own.

It is, of course, certain that, had chloroform been so commonly known as it is now, when the last alteration in the tariff was made, a countervailing duty would have been charged bpon it, as in the case of ether.

A gallon of ordinary rectified spirit produces about 4lbs. of commercial ether, and upon this foundation is based the extra amount of duty which is to be paid upon it when brought to England from those parts of the United Kingdom in which the duty is lower: still it is a well-known fact that ether may be obtained in the English market at the bare cost of the duty—namely, 2s. 6d. per pound.

There cannot be any doubt that, if Government does not relieve from duty, at any rate spirit to be use for manufacturing purposes, as chloroform has become a commercial article of considerable importance, an endeavor will be made to charge upon it the extra amount of duty, as in the case of ether, &c.

The English manufacturer wants to be permitted to use alcohol duty free for manufacturing purposes; and there is no efficient reason why he should not have this opportunity, nor why he should be compelled to seek substitutes. It cannot be expected that any manufacture in which alcohol is so important an element as in chloroform and ether, can thrive when so excessive and exorbitant a duty is charged on it. The application of these compounds to many useful purposes is retarded or prevented by it.

It deeply concerns many of our readers to obtain from Government permission to use alcohol for manufacturing purposes duty free; and we strongly recommend them to enforce their claims on Her Majesty's Ministers. Our columns will be cheerfully devoted to the subject.

ON THE ALLOYS OF GOLD AND SILVER, USED IN THE MANUFACTURE OF PLATE, JEWELLERY, &c., WITH AN EXPOSITION OF THE VARIOUS FRAUDS PRACTISED THEREIN.

BY W. GRIFFITHS, WORKING GOLDSMITH.

LETTER III.

To the Editors of The Chemist.

DEAR SIRS—In your last number I gave the method of mixing the metals to form the 18 carats alloy of gold; I now proceed with the methods of coloring and finishing articles of jewellery made of that alloy.

The work to be colored when finished in form (that is filed up to the particular shape required) is annealed and thrown into a solution of sulphuric acid and water, in the proportions of 1 acid to 10 water, which acid solution removes the oxide of copper from the surface, leaving the work of a pale green color, owing to the particles of gold and silver being exposed, as the copper on its surface has been removed by the combination of its oxide (created by its cooling after being annealed) with the sulphuric acid pickle forming sulphate of the oxide of copper. The article is then well rubbed with a piece of water Ayr stone, to remove the file marks; then a stick of wood (hazel wood is generally used) is charged with rotten-stone and oil, and the stick is well rubbed to the surface of the work, until the marks of the water Ayr stone are obliterated; a "buff," i.e. a piece

of leather glued to a stick, is then applied, to further smooth the surface; then the article is cleaned in spirits of turpentine, to remove grease, &c., *and rouge*, mixed with water, applied, until the surface is highly polished: the articles are then annealed and cooled to oxidize again, and they are fit for the coloring process, which is thus performed.

This alloy of gold is generally "dry colored," as in 18 carat alloy it is necessary to exhibit its quality by its brightness and richness of color, to distinguish the work made of that alloy from wet colored work. The salts used to produce the desired effect are these, and thus applied:—

	oz.	*dwt.*	
Nitrate of Potassa (Saltpetre)	8	0	troy
Potassa Sulphate of Alumina (Alum)	4	0	„
Chloride of Sodium (Common Salt)	4	0	„
	16	0	

The common salt is dried previous to weighing it; otherwise it would contain an unknown amount of water, *no* water being used in the operation, except the known or average quantity contained in the alum (about 49 per cent) which is essential to aid in the perfect fusion of the salts.

When the salts have been weighed and well mixed, they are put into an iron crucible, which is placed in a forge fire, and heated until the nitro-muriatic vapors are evolved and the salts are in a state of fusion: great care must be observed that no organic matter be present, or ignition will take place: even the sparks from the charcoal fire being sufficient to ignite the salts; when the latter are perfectly fused, the crucible is withdrawn from the fire, and the work to be colored (previously hung on a platinum wire) is plunged into the intumescent mass, rapidly agitated for a few seconds, then as quickly as possible plunged into a mixture of 1 part nitric acid with 24 parts water, as hot as possible; this mixture dissolves the salts which have remained on the surface, and leaves the work of a rich gold color, and as bright as when placed in the solution of salts, &c.

My views of the chemical agency of this result are these: I consider that the great amount of heat required to fuse the salts to dryness, evolves nearly all the nitric acid contained in the nitrate of potassa, as also the chlorine contained in the chloride of sodium, and that when those gases are evolved, there remains scarcely any hydrochloric acid behind to attack the gold; that the sulphuric acid contained in the alum attacks the oxide formed by the slight amount of oxygen contained in the nitrate of potassa after the evolution of the gases, as it is clear by the result that they are not *all* evolved by the heat applied, and, as in the wet coloring process a certain result is evident, namely, that the greater the amount of water supplied to the salts at first, the more matted the surface will be, I also think that the less moisture supplied, the less will be the capability of the solution of retaining the nitro-muriatic acid, hence the brightness of work by the "dry coloring," and the deadness or matted appearance of it by the wet coloring process is made evident by the presence or absence of sufficient water to retain the nitro-muriate in its solutions of the salts employed, as the nitro-muriatic acid affects the gold which the salts do not, they merely act on the oxides of the inferior metals, thus, the sulphate of potassa contained in the alum unites with the potassa of the nitrate of potassa, forming a potassio sulphate (if I may be allowed the term) the potassa in excess; the sulphate being the active agent, the potassa the passive agent, as in this process *no gold* is left in the color (which is not the case in "wet coloring," a considerable amount of gold being taken up, which may be detected in the "color" by the usual tests) so I consider that in this, as in the other processes I have detailed, that the sulphuric acid (not being volatile like the other two acids, viz., nitric and muriatic) remains in the solution, that it attacks the oxide formed by the nitric acid, or by the heating or cooling of the work previous to its being placed in the solution of salts, producing a sulphate of copper or probably a sulphuret of silver and copper in the salts, leaving the work of a color and appearance resembling polished fine gold. I will advance what I consider another proof of my opinion—it is that when the process of dry coloring fails in producing the result required, we add, on the second application of the salts, a few drops of nitric acid to them, to produce oxidation of the silver, as a second application is never necessary when the copper is in excess in the alloy, but only when silver is the metal to be removed, proving that the first application of the salts was not sufficient to oxidise the silver, and that it required the aid of nitric acid to produce the state of oxidation necessary to its removal by the sulphates, as silver requires a high state of oxidation, or the sulphuric acid, even in combination with nitrate of potassa, will not thoroughly remove it from the surface of the object acted upon, if nitrous gas be at all evolved previous to its immersion in the salts, &c.,

that even in the most skilful hands the process of dry coloring 18 carat gold is a difficult matter, requiring more chemical knowledge than the ordinary workman is likely to possess to render the operation certain. Seeing this difficulty, some years ago I applied myself to the discovery of a process more simple and less dangerous in its operation, to supersede it. I considered that the reason why the salts usually employed in a mild way would not attack the surface of 18 carat alloy must be that its quality was too good to allow of their action. I then conceived the following plan to effect the desired purpose:—I took two salts of copper, the sulphate of the oxide, and the acetate of copper, and mixed them in equal proportions: to these I added somewhat more than their weight of equal proportions of muriate of ammonia and nitrate of potassa. I then dissolved the whole in acetic acid, slightly heated. I then painted over the surface of the article to be colored (it being previously well polished) with the solution as described, and then applied heat; the low heat at first applied precipitated the copper from its solutions upon the surface of the work, forming an alloy as it were upon its immediate surface, which as soon as sufficient heat was applied to cause the salts to react, was removed by them. Thus, when the low temperature was applied, the acids holding the copper in solution were evolved, the copper was precipitated on the surface of the work, the muriatic acid of the sal ammoniac) dissolved the silver, then volatilized as the heat increased; the nitric acid of the nitrate of potassa then did its work, the oxygen of the nitric acid combined with the copper, the ammonia and potassa forming salts of the entire copper and silver, not only removing the copper precipitated from the salts of copper, but also removing the copper and silver from the surface of the work, as the copper precipitated from the salts upon the surface of the work rendered the alloy of gold attackable as it were by adding to its amount of alloy, so as to render its immediate surface liable to be affected by the salts, which before the deposition of the copper would have had no effect at all upon the surface of the gold alloy: the color after the removal of the fused salts by diluted sulphuric acid, is a rich fine gold color, and I have also found this method an excellent test for gold alloys, as it will not color any alloy under 17 carats if bright polished, although it will restore old wet colored or strongly gilt work to its original appearance: the final process is that of washing in potassa ley after the removal from the sulphuric acid, drying in box wood dust, and the article colored is fit for use.

I remain, Dear Sirs,
Truly yours,
WM. GRIFFITHS.

Dublin.

ON A NEW GUNPOWDER, WITH PRUSSIATE OF POTASSA FOR A BASE.*

BY M. AUGENDRE.

THE author, after mentioning at what point he commenced his researches and his first experiments, announces that he has at length found the mixture which appears to unite all advantages, being of a simple numerical proportion and giving the greatest amount of useful effect, and at the same time with the least residue. This is the mixture:

Crystallised yellow prussiate of potassa, reduced to a powder.....	1 part by weight
White sugar.....do...	1 do.
Chlorate of potassa do...	2 do.

These three substances, separately reduced to a fine powder, are then mixed with the hand. If contented with a trial with a few grains, we may grind them dry in an agate mortar. There is nothing to fear from the most powerful friction. To operate on a larger mass, moisten the mixture with 2 or 3 per cent. of water, and beat it in a brass mortar with a wooden pestle or *vice versa*. I have for a long time used a brass pestle and mortar, and never had an accident. The mixture need not be so intimate as for common gunpowder: one quarter of an hour's beating should suffice. It is ground in the ordinary manner, and dried in the air.

This powder, either in grains or in impalpable powder, inflames easily by contact with a red hot body or a flame. The flame it produces is larger than that of ordinary gunpowder, but leaves little residue. When just out of the mortar it inflames perfectly, so that we are not exposed, with it, to a failure in the explosion; it is not liable to spoil as the common powder is. It must be very dry for a violent blow, of iron on iron, to cause detonation. Friction between two polished bodies will never produce this effect; it is the same with a shock produced by wood on wood or wood on metal.

The advantages of this powder are:—

1st. Being formed of substances of a perfectly determinate and fixed composition, so that when once an estimation is adopted we may always count on an identically similar

* *Comptes Rendus*, 18th Feb., 1850.

force; 2nd. that these substances are unaltered by the action of either moist or dry air, so that it can be preserved for an indefinite period, which cannot be done with the charcoal which is employed for ordinary powder; 3rd. that as it takes less time to make, we could, if necessary supply a garrison with the materials reduced to powder, and make it up when wanted, which would avoid the danger of the present large powder magazines; 4th, that its dynamic force being very considerable, the cartridge chests might be made to contain a greater number of charges, the diameter of the bombs, howitzers, etc., might be reduced and their thickness increased; 5th, that the priming powder of this powder has all the power of the grained powder, a circumstance which will permit of this powder being prepared by simply reducing the materials to powder and placing them in a leather vessel turning slowly on its axis. I will add that the prussiate gunpowder is not poisonous; it is merely a slight purgative.

Its inconveniences are:—

1st. It oxidises iron arms, because of the chlorate of potassa which it contains, which must confine its use to brazen guns and hollow projectiles; 2nd.: being more inflammable than counmon gunpowder, although much less so than any of the chlorate powders hitherto tried.

I cannot terminate this memoir without mentioning an accident that happened to me, but I only speak of it because two important consequences flow from it.

I had for some time used prussiate powder for shooting, and carried it in a powder flask. Wishing afterwards to change my proportions, I emptied what remained on to a sheet of paper, intending to regrind it. I remarked several black grains of common powder among mine, which is white; but did not at the moment draw any inference from it. I commenced pulverising in a wedgewood mortar another portion of prussiate powder which had not been in my powder flask, and my operation went on all right, as usual; I then put into the mortar, which was on a level with my chest, the contents of my powder flask, which might amount to 60 grammes. I had no sooner given the pestle two turns than my head was thrown back by an explosion, similar to the discharge of a cannon. The mortar however was not broken. I lost my eyelashes and eyebrows, and remained for two days uncertain whether I had not lost my eyes, being unable to open them in the light.

This fact clearly establishes the difference between the mixtures of chlorate of potassa and charcoal or sulphur and the prussiate gunpowder. In the first case, the combustible bodies are in a free state, and the least friction inflames the mixture; in the second case, they are in a state of combination, which requires a certain force to destroy it.

It is therefore necessary, in the preparation of the prussiate powder, to avoid introducing the least particle of charcoal or sulphur, and to avoid most carefully any mixture of this powder with common powder in all circumstances where friction may be foreseen.

EXPLOSION OF POWDER MILLS AT HOUNSLOW.

On Monday, the 11th ult., a most terrific explosion took place at the Powder Mills of Messrs. Curtis and Harvey, near Hounslow. Eight men were killed and two very severely injured. The following account of the explosion is taken from *The Times* of Wednesday, March 13th.

"In order to render the account of this intelligible, it is necessary to give some description of the manner in which the powder mills are arranged. The buildings are nearly all placed at some distance from each other, and those in which the more dangerous processes of the manufacture are carried on are carefully secluded from the rest by thick belts of fir wood, by mounds of earth, or by such other means as the position in which they are situated suggests. Nearly all the works are constructed of the lightest materials, so that if an explosion should happen, the least possible resistance may be offered to the shock which it occasions. Through the grounds, which occupy a considerable extent, runs the river Colne, a tributary of the Thames, the waters of which are applied to set the machinery of some of the composition and corning houses in motion. The situation of the works generally appears to be unexceptionable, being thoroughly removed from the public highway, and from those dangers to which an exposed position leads. All these precautions, however, seem to have entirely failed in the moment of trial, and the explosion which took place on Monday must be regarded as one of the most serious and alarming accidents of the kind that have happened for years in this country.

"It appears to be quite ascertained that the mischief commenced in what is called the 'Treble Dusting-house,' *i. e.*, the house for 'dusting' or cleansing sporting powder, which was situated on the eastern margin of a fir plantation, with a field of turnips on the one side of it and the wood on the other. In this small building no machinery of any

kind was kept which could at all lead to such a catastrophe. Two small spindles and a sieve of copper wire were the only implements employed; and how anything could have arisen to create combustion here is the mystery which must be solved before the origin of the accident can be understood. The two ill-fated beings who worked here have both been killed, and no direct evidence on the subject can, therefore, be obtained; but one thing at least is certain, that "dusting-houses" are not usually looked upon as the dangerous portions of powder mills, or those where explosions are most likely to happen. The men employed there are described as exceedingly steady and experienced persons, and the character given of them goes a great way to rebut any presumption of carelessness that might arise under the circumstances. The quantity of powder stated to have been in the dusting-house when the accident happened is 2 cwt.—a small quantity certainly to have caused such a wide-spread destruction.

"Not a single stone of the building remains —the whole fabric having been blown away, and the scathed and blackened foundations alone remaining. The trees for many yards on the western side have been either torn up by the roots or cut right through, or had their branches or bark stripped off. Nor has the turnip field on the eastern side of the building escaped uninjured, for the unmistakeable action of fire may be distinctly observed over a considerable portion of it; and so great was the shock of the explosion, that a house standing beyond this field, at a distance of about 300 yards, had its windows broken, and a picture in one of the rooms rent by the concussion. This is the more remarkable, as the wind was at the time blowing from the east—a circumstance to which some consequence appears to be attributed, as it is said that accidents of the kind are generally observed to take place with an easterly wind and a high barometer.

"From the dusting-house the evil consequences of the first explosion extended to the 'treble,' or sporting powder corning-house, which stood about 100 yards westward, embedded in the plantation of wood, on the outskirts of which the dusting-house was situated. Whether the second explosion was caused by burning embers from the first falling upon the premises, or by a large body of flame carried through the trees by the wind, it is impossible to say, but the result was equally disastrous, and the destruction caused quite as complete. Here again the terrific power of gunpowder displayed itself in the most astonishing manner, though the whole amount in the building at the time is stated not to have exceeded 1½ cwt. It is said that one of the men employed at this point, alarmed by the report at the dusting-house, rushed into the open air in the hope of making his escape, and that he had only got a short way when the second explosion took place, and killed him.

"In the account of the accident which appeared in yesterday's *Times*, it was stated that the loudest report of all was that which came third. A visit to the scene of the catastrophe soon shows how this happened. The building in which the third explosion occurred was the press-house, and was much more substantially constructed than the rest. In it, according to custom, about 4 cwt. of powder had been left to be pressed, and the resistance offered being greater, as well as the quantity of combustible material larger, the shock had proved more alarming. Providentially, however, in this instance the loss of property is all that remains to be deplored. The men had left a few minutes before the accident, and thus three lives were saved. Nothing can be imagined more complete than the destruction of this building, the machinery with which it was provided being wrenched into pieces, and large square blocks of teak-wood, weighing several cwt., being carried right across a mill-stream which flows on the north side of the premises.

To the press-house succeeded the glazing-house, also a rather substantial edifice, and the explosion there was followed by that in the roller corning-house, where three men lost their lives. These last-mentioned premises contained about 2 cwt. of powder, and such was the force of the explosion that a part of the machinery with which it was fitted, weighing nearly 3 cwt., was carried right over some high trees and into a field beyond, thus travelling through the air a distance of several hundred yards.

"The five buildings, the destruction of which we have just explained, are all well protected from each other by wood or embankments, and the distance between them is considerable. The three last-mentioned lie in a south-easterly direction from the dusting-house, where the mischief commenced, and the supposition is that the wind exercised a great influence in the extent of the disaster caused. It is singular, however, that a burning brand was thrown by the force of the first explosion close to the packing-house, where a considerable quantity of powder is kept, and which stands in a plantation to the north of the point where the catastrophe is said to have had its origin.

"The appearance presented at all the spots where the great explosions took place is, as nearly as possible, the same, not one

stone being left upon another, the foundations being laid bare, the trees for some distance around being shattered, overthrown, and scorched, and the ground being strewed with bricks, pieces of timber, and fragments of machinery. A portion of a water-wheel was resting between the boughs of a fir tree, near its summit, and several heavy rollers, after being hurled upwards to a great height, had embedded themselves deeply in the earth.

"Besides the five great explosions, two smaller ones occurred in other portions of the works; but as these did not do much damage beyond displacing a few timbers in the roof, it is not necessary to enter into any details with regard to them. Among the heavier disasters of the day, the composition-house, that in which the materials of gunpowder are brought together, took fire, and everything, except those solid portions of the machinery which would not burn, was reduced to ashes. This record of the disasters which have overtaken the works of Messrs. Curtis and Harvey would not be complete without mentioning that the roofs of nearly all the buildings within reach of those where the explosions took place have been almost entirely destroyed, the tiles being displaced as if by a hurricane. The windows have also been blown in and plaster shaken off the walls."

PREPARATION OF A TRACING PAPER FOR THE USE OF ARTISTS, FREE FROM OILY MATTERS.

To the Editors of The Chemist.

GENTLEMEN—A tracing paper capable of being written on with pen and ink, and at the same time time to be of such a nature as to receive coats of water-color, as common paper does, has been in universal request: the ordinary article does not possess these important qualifications, which arises from the oily nature of the substances employed to impart the required degree of transparency. However carefully the papers are dried, there is always an adherent coat or film on the surface, which effectually repulses aqueous fluids.

To prepare the new tracing paper, all that has to be done is, to steep the sheets in a strong solution of gum arabic, and afterwards take off the superfluity by pressing between two other sheets of dry paper; on inspection it will be found that all three papers are converted into a first-rate tracing paper. It is indispensible that the solution be strong—about the consistence of boiled oil. The gum-water, singularly enough, leaves a mark on paper or linen, precisely like that of oil.

The paper prepared as just directed is so perfectly adapted to fulfil the conditions required, that nothing further can be now desired, the article possessing every requisite that can be thought of or wished for.

Your obedient servant,
T. W. N.

RESHARPENING OF OLD FILES AND RASPS BY A CHEMICAL PROCESS.

To the Editors of The Chemist.

GENTLEMEN—I have discovered that old rasps and files may be made nearly equal to new ones, by the following simple, easy, and cheap process:—

First boil them in soap-leys (or a mixture of slaked lime and soda in water); this being done, wash them in water and directly throw them into a tub full of dilute sulphuric acid, formed of 1 part acid and 6 parts water; let them remain here for some time, the exact period is easily found by taking out a file and observing whether the nicks appear sharp or not: as soon as the desired sharpening is effected the files must be taken out and washed in another tub containing solution of soda—about an ounce of soda to a pail full of water.

If this merits a place in the "Chemist," I trust you will honor me by its insertion.

I am, Gentlemen,
Your obedient servant,
T. W. N.

BEAUTIFUL CRIMSON FLAME FOR THEATRES, &c.

To the Editors of The Chemist.

GENTLEMEN—I here give you a recipe for producing a deep blood-red flame, suitable for dæmons' torches, used in the theatre, circus, and such like places of entertainment.

Boil 2 oz. of nitrate of strontia with ½ oz. of hydrochloric acid in a cup; boil the mixture to dryness; when cool, add about 4 oz. of pyroxylic spirit; dab a ball of wadding into the mess, and fix it to the end of the torch. Nothing can exceed the beauty of this flame, particularly if the torch be waved freely about.

I am, Gentlemen,
Yours truly,
M. NEWNUM.

ABSTRACTS OF SPECIFICATIONS OF CHEMICAL PATENTS RECENTLY ENROLLED.*

Improvements in Manufacturing and Refining Sugar. A. V. NEWTON. (Communication.) Sealed Aug. 23, 1849.

CLAIMS.—1. The use of the bisulphites or acid sulphites (particularly the bisulphite of lime), as preservatives against fermentation, and as depurators of vegetable juices containing saccharine matters.

2. The use of various antiseptic agents as preventives to fermentation in juices containing sugar.

3. The employment of baryta, strontia, the sulphurets of barium and strontium, of lime, or other metallic oxide, for precipitating and separating the crystallisable sugar contained in fluids, in the form of insoluble saccharates.

4. A mode of forming saccharates of the above-mentioned substances.

5. The use of bisulphites and acid sulphites, (particularly the bisulphite of lime), for the defecation of saccharine solutions.

Improvements in Manufacturing Orchil and Cudbear. JAS. ROBINSON. Sealed Aug. 30, 1849.

The patentee remarks, that it has hitherto been customary in the manufacture of orchil to mix the lichens with liquid ammonia to form a paste, which is turned over at intervals, to expose it to the action of the air, whereby a considerable time and amount of labor is lost; and that his improvement in the manufacture of orchil consists in forcing the paste, prepared as heretofore, through the perforated bottom of a cylinder, by means of a plunger, into a receiver, whereby a greater amount of surface will be exposed to the atmosphere.

The improvement in the manufacture of cudbear consists in drying it more rapidly than has yet been practicable, by forcing the paste through orifices on to a surface lightly.

CLAIMS.—1. Causing the paste to pass through orifices or openings, whereby the surface is more largely exposed to the atmospheric air.

2. The mode of drying the paste when converting it into cudbear.

Improvements in the manufacture of Steel. J. M. HEATH. Sealed Sept. 6, 1849.

The improvements included in this patent consist in subjecting iron, in a granular state, obtained by the cementation or deoxidation of ores (by preference magnetic ores) to a welding heat, in combination with manganese and carbon. The iron is afterwards made into bloom, then into bars or slabs, which are subsequently converted in the usual way. The proportions given by the patentee are, 1 to 3 lbs. of oxide or chloride of manganese, and 1 to 2 gallons of coal tar, or other hydrocarbon, to every 100 lbs. of iron.

CLAIM.—Subjecting iron in a granular state to a welding heat, when combined with manganese and carbon: which iron is afterwards to be made into bars or slabs, or other suitable form, and converted.

* Collected from *The Mechanics' Magazine.*

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

THREAT OF THE COUNCIL OF THE PHARMACEUTICAL SOCIETY TO SUE "DEFAULTERS" FOR THEIR SUBSCRIPTIONS. PROPOSED BILL TO REQUIRE THE LEGAL QUAIFICATION OF PHARMACEUTICAL CHEMISTS.

ON the cover of a recent No. of the Pharmaceutical Journal, we noticed the following:—

"Extract from the Bye-Laws."

"All Annual subscriptions shall become due on the 1st of January in each year.

"Any Member who shall not have paid his subscription prior to the 1st of May in any year, shall be held to be a defaulter, and it shall be in the discretion of the Council to declare him no longer a member."

We cannot understand the employment of

the word "defaulter;" it would appear to be connected with a rumor which has been abroad some time, that it was the intention of the Council to resort to the desperate alternative of suing all "defaulters" for arrears of subscription. We have not heard that any legal measures have been taken against any member on this ground, but we should think that the defendant would have the best of the trial. No one can be compelled to pay an annual subscription to any society; it would indeed be hard if a man might not put an end to his membership whenever he pleased.

Hundreds joined the Pharmaceutical Society in the hope that some legal qualification would be obtained for pharmaceutical chemists from the Government. Nearly NINE YEARS have passed over the existence of that society, and nothing approaching to this desideratum has been effected. Any one may set up a chemists' shop, undertake the treatment of the sick over his counter, and sell medicines of the nature of which he knows nothing.

It was the duty of the Council, instead of such trifling as obtaining a valueless charter of incorporation, which merely settled the constitution of the society, to have at once effected the introduction into Parliament, of a bill containing provisions for allowing all pharmaceutical chemists in practice at the time to continue in practice, only requiring them to be registered on or before a certain day, (as in the case of the apothecaries' act of 1815), and enacting that from that day forward no person be allowed to pratice as a pharmaceutical chemist without passing an examination as to his qualification. We would not require that he should have attended lectures at any institution in London; we would not care where he got his knowledge, so that he possessed sufficient to pass a very careful examination. It would be no hardship on any young man about to enter into so important a business as that of a pharmaceutical chemist to have to come from any part of the kingdom to London for examination, and to pay a fee of perhaps £10 to the examiners.

The Government cannot put an end to counter practice, and it would be a manifest injustice to the phaamaceutist that he should be compelled to direct all applicants to the nearest medical man, who would certainly supply the medicine as well as the advice; at the same time it is nothing but just, and all respectable members of the body desire it, that their qualification for the duty be established on a legal basis. The absence of this legal qualification is one of the grossest absurdities of the age.

As the Pharmaceutical Society has taken no step in this direction, we suggest to the principal wholesale and retail houses the propriety of meeting, framing a measure making the necessary provisions, and getting the same introduced into Parliament. We feel confident that very little, if any, opposition would be made to a fair and reasonable demand on the part of the trade. It is high time that the trade should give up the shadow of dependance on a Society which has done nothing for nine years.

Such of our readers as belong to the Pharmaceutical Society are reminded that on the 1st of next month, if they have not paid their annual subscription, the Council may in its "discretion" declare them no longer members. It appears somewhat extraordinary, that the members are to be allowed no discretion: if they do not pay, they will be sued, and *may* be turned out, but will not be permitted to discontinue of their own accord. We hope our readers will resist this unjustifiable course, and vindicate their power of acting as pleases themselves. As to the compulsion to return the "certificate of membership," we are not aware of the question having been tried. We know one gentlemen who has lost his. If a chemist chose to burn or otherwise mutilate or destroy his certificate, what remedy would the Society have against him if he declined to pay his subscription? We cannot see that it would have any.

We earnestly invite our readers attention to the important subject of a legal qualification, to which we shall return in our next.

We know that there is very strong feeling in the trade in favor of it and against the Pharmaceutical Society.

We shall be happy to receive communications concerning this important matter; and we hope that we shall see some immediate steps taken: willingly shall we lend all the aid in our power to any proper and feasible plan for remedying a state of things so injurious to the community and unsatisfactory to all right-thinking pharmaceutical chemists. We do not recommend a course which will be expensive or troublesome. We merely suggest that some influential members of the body should meet and draw up a bill, which would be discussed by the trade through the medium of the public press, and assented to by silence or dissented from by petition.

THE PHARMACEUTICAL SOCIETY AND QUACKERY.

If any thing were wanting to show the utter disinclination of the Pharmaceutical Society to put down Quackery amongst its members, the want would be supplied by the fact that no officer of the Society has been to see the two handbills mentioned in our January No. as having been issued by a person (a "Member of the Pharmaceutical Society by Examination") in Camden Town, extolling the miraculous properties of his "Infallible Restorative Elixir," "Antecedent Lotion," and "Pectoral Cough Candy." In our remarks on this vile case, we said that we would exhibit the bills to any one who would call at our office from the Society; we made this offer to try the zeal of the Society for the welfare of the trade, and we have found it wanting.

The fellow still placards the streets of his vicinity with his moral filth. The Society has not even attempted to do its duty in this case. It is evidently a question of £1 11s. 6d. per annum. It is high time that the interests of the trade were in better hands.

We expect to be able to lay before our readers in the course of a short time, a few more very bad cases, both of abominable quackery and the adulteration of drugs.

CORRESPONDENCE BETWEEN MESSRS. HEATHFIELD AND BURGESS, AND MESSRS. J. AND J. WRIGHT.

To the Editors of The Chemist.

Princes Square, March 19, 1850.

Gentlemen—Having recently sent some muriate and acetate of morphia to Messrs. Wright, of Holborn, Druggists, we were informed by them that on examination they had been found to contain sugar, in consequence of which we made application to them on the 20th ult., to state the nature of the impurity, and upon whose authority that statement was made, which information Messrs. J. and J. Wright have declined to furnish. We shall feel much obliged by your insertion of the following correspondence, as we feel bound to adopt this course in our own justification, believing that public attention has been called to this matter.

COPY OF CORRESPONDENCE.

(No. 1.)

"134, High Holborn, Feb. 21, 1850.

"Gentlemen—With this we beg to return the 4 oz. each of acetate and muriate morphia had from you a short time since. It has been examined at the College of Chemistry, and again here, and we find it is not pure.

"We remain, Gentlemen,

"Your obedient servants,

(Signed) "J. & J. Wright."

"Messrs. Heathfield & Co.,
Princes Square.

(No. 2.)

"Princes Square, Feb. 25, 1850.

"Gentlemen—Unless we have a distinct answer to our letter of the 20th inst., we decline to give you credit for the morphia you have returned. We may state that we have made enquiry at the College of Chemistry, and find that no efficient examination of salts of morphia has been made.

"Your obedient servants,

(Signed) "Heathfield & Burgess."

"To Messrs. Wright & Wright.

(No 3.)

"Princes Square, Feb. 27, 1850.

"Gentlemen—We must once more request to know if you object to inform us upon whose authority you state that our preparations of morphia are impure; in the event of your declining to do so, it is our intention to make the matter one of public investigation.

"Your obedient servants,

(Signed) "Heathfield & Burgess."

"To Messrs. Wright & Wright.

(No. 4.)

"134, High Holborn, Feb. 28, 1850.

"GENTLEMEN—In our last note we informed you that your morphia had been examined at the College of Chemistry and again here. Since then we have had it examined by Mr. Morson, whose examination as regards the acetate confirms what we have before stated.

"We remain, Gentlemen,

"Your obedient servants,

(Signed) "J. & J. WRIGHT."

"Messrs. Heathfield & Burgess,
Finsbury."

(No. 5.)

"Princes Square, March 1st, 1850.

"To Mr. Morson.

"SIR—We enclose a copy of a note we have received from Messrs. Wright and shall be obliged by your informing us, by return of post, whether you have examined any preparations of Morphia for them, and if so, what is the nature of the impurity you have found therein.

"Your obedient servants,

(Signed) "HEATHFIELD & BURGESS.

(A copy of No. 4 was enclosed with the above.)

(No, 6.)

"19, Southampton Row, March 2nd, 1850.

"Mr. Morson, in reply to Messrs. Heathfield & Burgess' note, informs them that he examined 2 samples of Morphia salts at the request of Messrs. Wright of Oxford Street, the purity of which, he was informed, is matter of dispute. He gave them the result of his examination, and must refer you to them for further information, it being a question that does not concern Mr. Morson in any way.

(No. 7.)

"Princes Square, March 2nd, 1850.

"To Messrs. J. & J. Wright.

"GENTLEMEN—We request you to let us have a copy of Mr. Morson's report of his analysis of the preparations of Morphia which we forwarded to you, and which you declare to be impure.

"We are, Gentlemen,

"Your obedient servants,

"HEATHFIELD & BURGESS.

(No. 8.)

"134, High Holborn, March 2nd, 1850.

"GENTLEMEN—We have already given our answer to your letter respecting the morphias; and, since you refuse to take it back, we decline to go into any further particulars. There is the article to speak for itself, and had you received it when sent to you, you might have furnished yourselves with particulars instead of giving us so much trouble in a matter where we ought to have had none.

"Your obedient servants,

(Signed) "J. & J. WRIGHT."

We now request Messrs. Wright to state the nature and proportion of the impurity found on examination of the Morphia at the College of Chemistry and by Mr. Morson.

We are, Gentlemen,

Your obedient servants,

HEATHFIELD & BURGESS.

ON SEMOLA, A NEW PREPARATION OF WHEAT GLUTEN AS AN ARTICLE OF DIET, WITH SOME GENERAL REMARKS ON FOOD.

BY LLOYD BULLOCK, ESQ.

[WE are induced, by the interest of the subject, to take from *The Lancet* of December 15th, 1849, and March 9th, 1850, two papers by Mr. Bullock, to whom we are indebted for a specimen of semola, which we are now trying, and on which we shall give our opinion next month].

(FIRST PAPER.)

"As the chemistry and physiology of digestion and nutrition become more clearly understood, an increasing interest attaches to the various articles of diet, and especially demands that their composition should be known with greater precision. The theory that assigns essentially different functions to the nitrogenous and non-nitrogenous principles of our food may now be regarded as established. And the further opinion, that many diseases either originate from, or are increased by, substances which are constant constituents of ordinary food, is certainly gaining ground, if, indeed, it be not already generally admitted. In the further application of chemistry to the elucidation of pathology, it would scarcely seem possible to arrive at satisfactory results without a tolerably accurate knowledge of the constitution of every article of diet.

"In the treatment of diseases, it must be of the highest importance for the practitioner to have a distinct knowledge of the composition of the substances he recommends; and to be able, on the one hand, to administer respiratory principles, or fuel, (as the non-nitrogenous substances in food are well termed), as they serve merely to maintain animal heat and satisfy the cravings of appetite, without supplying nourishment, properly so-called; and, on

the other hand, to give articles of diet which are simply nutritive, with as little admixture as possible of matter not convertible into blood and flesh.

"An animal diet would seem, at first sight, to supply exactly the last desideratum, as a small admixture of fat might serve the respiratory process and supply a sufficient amount of animal heat. But it is found that animal food, given alone, or without some admixture of farinaceous principles, quickly becomes loathed and abandoned. Indeed, it is no more practicable to keep up an adequate supply of nutrition, by means of animal food, than it would be to give wine and alcohol to serve as fuel. They would both probably be injurious to the system in the same way—namely, by accelerating the functions beyond the normal action, (that is, act as stimulants), and thus induce disease.

"Hence it would appear to be an object of primary importance, in a regulated system of diet, to be able to separate the vegetable nutritive principles from the large amount of starch, woody fibre, sugar, &c., with which they are naturally associated; and thus to have the means of administering nourishment without stimulating and in a small bulk. In the special case of diabetes, it has long been recognised as a desideratum to find some vegetable substances congenial to the stomach, and at the same time highly nutritious, with as little starch as possible. In many forms of indigestion and diseases of debility, it must be equally desirable to administer a diet of a similar character—namely, as nutritive as animal food, without stimulating. There is no substance in nature which seems to possess the required chemical composition and properties so perfectly as wheat gluten, and the facility with which this is separated from the starch, sugar, &c., of the wheat, has directed much attention to it. But all attempts hitherto made to convert gluten into a palatable and manageable food have failed. Perhaps too much has been aimed at, as most of the suggestions made on the subject have contemplated the entire exclusion of starch,—such was the intention of Bouchardat, in his plan for making gluten bread.

"I have myself prepared the gluten bread for the profession to a considerable amount, and find it impossible to produce an eatable, not to say palatable bread, without the addition of a large proportion of flour. The cost of this bread, too, is necessarily very great, totally precluding its general adoption, even in the comparatively rare case of diabetes, and it is so disagreeable to eat that it has scarcely been tried in other diseases.

"Dr. Percy has recently recommended the mixing of fine pollard, or ground bran, or the woody fibre of the potato with the gluten. These substances may serve to modify, to some extent, the tough texture of the gluten, but they certainly do not make gluten bread more agreeable or more digestible.

"These remarks may serve to explain my reasons for now requesting the attention of the profession to a new article of diet, under the title of SEMOLA: A highly respectable mercantile firm having requested me to examine a substance which they propose to sell under that title, I find that it contains between fifty and sixty per cent. of wheat gluten, and to consist of this, together with pure wheat starch, in a physical condition, which renders it admirably adapted to become a general article of diet.* Having been made acquainted with the process adopted in its preparation, I was enabled to suggest certain modifications, by means of which an article, uniform in composition, agreeable to the taste, and well adapted for a variety of culinary purposes, may be manufactured.

"It must surely be a matter of great importance, to possess a substance containing so large a proportion of the staminal principle of nutrition in a form agreeable to the stomach and pleasant to the taste, to recommend in cases of debility, whether local or general.

"Perhaps it would be unbecoming in me to dwell upon the special application of a substance of this character, as the profession will perceive at once how well adapted it is to be made the food of children, as supplying flesh and blood as freely without stimulating like animal food; and how numerous are the occasions when it is desirable to furnish to persons of weak digestion a bland and highly nutritive diet?

"Let it be observed that the practitioner is not called upon to recommend an empirical food, like those sold under the name 'farinaceous,' 'infant's food,' &c., which are merely mixtures of the flour of the cheaper grains, oats, barley, &c., with raw or baked wheat flour.

"The composition of Semola, as I have observed, is uniform, and its physical form renders it highly agreeable when cooked

*A substance has been sold for some time in France, richer in gluten than wheat flour, but containing far less than semola.

as water-gruel, milk-gruel, or made into boiled or baked puddings, added to soups, or in any other way. In all cases it is much relished. In conclusion, I cannot but think that the chemical composition and properties of Semola must render it a very valuable adjunct to remedies, and recommend it to the general adoption of the profession. Whether the small amount of starch it contains, beyond that necessarily added to gluten bread, will preclude its use in diabetes, remains, I conceive, to be determined experimentally. There is no other case, so far as I know, where any attempt to supply food altogether without starch is desirable, and diabetes is happily rare: most assuredly that object has not hitherto been, nor is it likely to be very soon effected, but I would suggest that most of the saccharine matter of the wheat flour being washed away in the preparation of the gluten, may render the presence of simple starch less objectionable.

ON SEMOLA.

(SECOND PAPER)

"My former paper upon this subject (see *The Lancet*, December 15, 1849) seems to have been very interesting to the profession. I have received so many communications and inquiries on the subject that I have been induced to pursue it with great care; and the few observations I have now to make will, I trust, prove equally acceptable. Many of my correspondents were desirous at once to obtain the semola, and, as I was anxious that no disappointments should arise, from any imperfection in the manufacture, I found it necessary, in the first place, to go carefully over the matter, more especially to ensure as perfect uniformity as possible in its composition, before it was brought into the market generally. That there should be many difficulties, at first, in manufacturing an article of constant composition will be evident, when it is considered how different the several kinds of wheat are in their amount of gluten. I consequently began by having a variety of samples of semola prepared for analysis. I conceived, for the purpose in view, it was most expedient to determine the amount of nitrogen given by each sample, as although this, strictly speaking, does not represent the precise amount of gluten, yet, the other nitrogenous constituents of wheat being equally nutritious, their functions in assimilation being considered the same, may be properly included and reckoned with the gluten. I therefore made the following nitrogen determinations. The mean of two analyses of each sample of semola gave—

	Nitrogen.		Gluten.
Semola, No. 1	.. 7 22	per cent.	= 45.96 per cent.
„ „ 2	.. 8.10	„	= 51.59 „
„ „ 3	.. 6 73	„	= 42.86 „
„ „ 4	.. 8.99	„	= 57 26 „
„ „ 5	..10 18	„	= 64 84 „
„ „ 6	.. 9 87	„	= 62.86 „

"In calculating the amount of gluten in each sample, it will be observed, that I assume 15.7 as the per centage of nitrogen contained in gluten: this is the proportion stated in Liebig's and Gregory's edition of Turner's Chemistry. The result of these analyses proved to me the necessity for still more precision in choosing the wheat from which the semola was prepared, and suggested some indispensable conditions in its manufacture. I can now state, with confidence, that semola is made with certainty of a very uniform composition, and that it contains fifty per cent. of wheat gluten.

"In my former paper I assumed that the distinction between the nitrogenous and non-nitrogenous principles of food was pretty generally recognised. To a certain extent this was somewhat premature: not only do many persons still refuse to recognise this distinction, but in some medical works published very recently, we find arrowroot and other substances, consisting principally of starch, recommended to be given in debility, and represented as highly nutritious. Now it should be remembered, that the different functions in the animal economy, fulfilled by these two classes of principles respectively, are established, not only on the analysis of food, and the substances derived therefrom in the body, which, by a safe process of reasoning, are assumed to be necessarily connected, but experiments have shown, that animals supplied only with starch or sugar will emaciate and die of starvation, whilst upon gluten they thrive and retain their health. Magendie's experiments upon dogs, taken in connexion with the investigations of chemists, have determined the doctrine in question, if anything in science can be brought to a final determination. I would therefore suggest the expediency of adhering in future to an uniform phraseology in speaking of diet; for although, in certain febrile conditions of the system, amylaceous food is necessary, it must follow that in non-febrile debility, easily assimilated nitrogenous principles are those whence alone invigoration can be expected. I think, however, it will be found, that

there is a considerable difference in the influence exerted on the constitution by the nitrogenous constituents of vegetables, and animal fibre, and albumen, and caseine. Wheat gluten, as it exists in the semola, is certainly less stimulating, whilst it is as nutritious as animal food. Several of my professional friends have given it to infants, children, and invalids, and their reports are uniform as to its being agreeable to the taste and stomach, not rejected by infants, like oat or barley gruel, &c. Indeed, in several instances where substituted for all other diet, it has proved remarkably efficient in weakly children, reviving and invigorating them in a most striking manner. When boiled in milk it leaves nothing to be desired in the way of food for infants, children, and invalids. Semola milk gruel is very agreeable as well as highly nutritious, and the combination may be especially recommended, for other reasons, as will appear from what follows.

"Another matter relative to diet, which the physiologist owes to chemistry, whilst it is perhaps too little regarded in prescribing for diseases, is the necessity for the maintenance of the due association of inorganic matters with the organic constituents of food. Dr. Bence Jones has, indeed, in his lectures, well stated, in a general way, this important consideration; but there are one or two practical suggestions I would append to his excellent remarks. In sifting wheaten flour, and the separation of the cuticle, other matters are left and rejected beside the insoluble woody fibre, which unless supplied from other sources, may be needed for the purposes of the living economy. A well-known tract, by a physician, dwells much on the propriety of including the entire wheat in food, and recommends bread always to be made of wheat-meal. This excellent recommendation will be but partially adopted, the habits of society being rather in favor of refinements of food than otherwise. In fact, most of the bread sold as meal-bread, is simply made of ordinary flour, to which some pollard has been added, to give the appearance of whole meal-bread. Thus the purpose of the author of the said tract is defeated.

"But there is another way to accomplish it, when it may be found desirable, in regulating the diet of a patient, to give all the constituents of wheat, merely to let him eat it simply boiled as a vegetable.

"Boiled wheat, eaten with hot meat, gravy, or butter sauce, is not only one of the most agreeable, but it is by far the most nutritious of all culinary vegetables. It requires to be boiled for nearly two hours, or to be steeped for ten or twelve before boiling, when about half an hour will be sufficient. It is really extraordinary that this wholesome and nourishing grain is not oftener used in the place of the potato in this way. At any rate, when the physician recognises the propriety of adding to food the entire constituents of the wheat, organic and inorganic, he may prescribe it in this way; and there is another incidental effect which may have some influence—namely, that it generally obviates constipation.

"The question of the connexion of inorganic matters with the processes of digestion and assimilation, and consequently of diet, has, however, a wider range. Dr. Garrod has thrown out the suggestion that sea-scurvy may probably depend upon the absence of potassa from the food of mariners, and that it is the presence of this element in green vegetables and acescent fruits which render them such effectual preventives or remedies for that disease. Now Liebig has shown, in his late work on Food, that in the process of salting meat, not only potassa but alkaline and earthy phosphates, and other substances, are extracted; and he observes, 'a change in the gastric juice, and consequently of the products of the digestive process, must be regarded as an inevitable result of a long-continued use of salted meat; and if, during digestion, the substances necessary to the transformation of that species of food be taken from other parts of the organism, those parts must lose their normal condition.' Chevreul has shown that when beef is boiled in water, the inorganic substances amount to a fourth part of the weight of the matters dissolved in the soup; and Liebig has proved that these consist principally of phosphate of potassa, lime, and magnesia, and chloride of potassium.

"The first practical suggestion I would make, in reference to this subject, is the propriety of adding the salts withdrawn from meat, in the process of salting, to the *biscuits* which form the staple of sea diet, If the due proportion in the quantities of the several saline substances were carefully maintained, they would certainly render sea-biscuit a far more valuable adjunct to the salted meat; in fact, they would supply exactly the inorganic constituents which the salt had withdrawn from the meat in the process necessary for its preservation.

Biscuits, with this addition, would doubtless be more wholesome, and would, in long voyages, especially those undertaken into high latitudes, where fresh meat or vegetables are for a long period unattainable, most probably be an efficient means of preventing scurvy and maintaining the health of the crew.

"In another part of his work, Liebig has mentioned chloride of potassium as being a very agreeable condiment, as well as most convenient form, for the introduction of potassa into the system. I would suggest to practitioners, whether it may not often happen that the medicines they prescribe and find efficient, become so, by adding an element to the food of the patient, unwittingly excluded from his course of diet? I see no reason, indeed, why a compound condiment, composed of a due mixture of chloride of sodium, chloride of potassium, and the phosphates, should not often be recommended in the place of common table-salt, which, according to the present improved methods of manufacture, is almost pure chloride of sodium—at any rate it does not contain the admixture of other saline materials which formerly adhered to it.

"Again, Liebig, in the work already alluded to, has inserted the following recipe for, and remarks on, the preparation of soup:—

"'The characters of flesh at once suggest the best method of preparing, in the short space of a few minutes, the strongest and most highly-flavored soup; and any one may convince himself, by the simplest experiments, of the truth of the assertion made by Proust, that those constituents of soup, on which the taste and other properties depend, exist ready formed in the flesh, and are not in any way products of the operation of boiling.

"'When one pound of lean beef, free of fat, and separated from the bones, in the finely chopped state in which it is used for beef-sausages or mince-meat, is uniformly mixed with its own weight of cold water, slowly heated to boiling, and the liquid, after boiling briskly for a minute or two, is strained through a towel from the coagulated albumen and the fibrine, now become hard and horny, we obtain an equal weight of the most aromatic soup, of such strength as cannot be obtained even by boiling for hours from a piece of flesh. When mixed with salt and the other usual additions by which soup is usually seasoned, and tinged somewhat darker by means of roasted onions or burnt sugar, it forms the very best soup that can be prepared from one pound of flesh.

"'The influence which the brown color of this soup, or color in general, exercises on the taste, in consequence of the ideas associated with the color in the mind, (idea of strength, concentration, &c.), may be rendered quite evident by the following experiment. The soup colored brown by means of caramel, is declared by all persons to have a much stronger taste than the same soup, when not colored; and yet the caramel, in point of fact, does not in any way actually heighten the taste.

"'If we allow the flesh to boil for a long time with the water, or if we boil down the soup, it acquires, spontaneously, when concentrated to a certain point, a brownish colour and a delicate flavor of roasted meat. If we evaporate it to dryness in the water-bath, or if possible, at a still lower temperature, we obtain a dark brown, soft mass, of which half an ounce suffices to convert one pound of water, with the addition of a little salt, into a strong well-flavored soup.

"'The tablets of so-called portable soup prepared in England and France are not to be compared to the extract of flesh just mentioned; for these are not made from flesh, but consist of gelatine, more or less pure, only distinguished from bone gelatine by its higher price.

"'From thirty-two pounds of lean beef, free from bones and fat (eight pounds dry meat and twenty-four pounds water), there is obtained one pound of true extract of flesh, which, from its necessarily high price, can hardly become an article of commerce; but if the experience of military surgeons agree with that of Parmentier, according to whom 'the dried extract of flesh, as an article of provision in the train of a body of troops, supplies to severely-wounded soilders a restorative or roborant, which, with a little wine, immediately revives their strength, exhausted by great loss of blood, and enables them to bear the transport to the nearest hospital,' it appears to me to be a matter of conscience to recommend to the attention of Government the proposal of Parmentier and of Proust.

"'Now that the composition of the extract of flesh is somewhat more accurately known, it ought to be easy to distinguish the genuine from the false. Of the true extract nearly eighty per cent. is soluble in alcohol of eighty-five per cent., whilst the ordinary tablets of portable soup rarely yield to that menstruum more than four or five per cent.

"'I consider this extract of flesh as not less valuable for the provisioning of ships and fortresses, in order to preserve the health of the crew or garrison, in those cases where fresh meat and vegetables are wanting, and the people are supported by salt meat.'

"Now, so far as the extraction of the inorganic matters, and of organic substances not coagulable by heat, are concerned, this process of Liebig is perfect; but it is very remarkable that all chemists who have recommended various methods of preparing soups from animal substances should have overlooked one most striking fact—namely, that by this and other similar processes they separate and reject one of the most valuable principles of nourishment—namely, the albumen. In pursuing some experiments on this subject, I have found that not only may this albumen be advantageously retained, but that when retained with the other soluble ingredients, it forms an article of diet, which, so far as its amount of nutritive matter is concerned, far surpasses any form of soup or broth whatever. However, when the inorganic constituents of meat, its flavor, and juices soluble in boiling water with some gelatine, are required, Liebig's plan of making soup is very simple and efficient. And this may be all that is desirable when given as a very light repast, or when intended to precede, in the usual way in which fashion has prescribed, a full meal of solid viands; for once fashion is right, such a light animalized fluid forms an addition to the gastric juice, and assists its office in the process of digestion.

"But if it be ever desirable to possess all the soluble nourishment of fresh meat, to be able to give, in a concentrated form, the essence of meat, it is necessary to proceed in its preparation in quite a different manner. Indeed, it appears to me that it must be often very advantageous to possess nutritive matter in a fluid form, free from insoluble fibrine, so constituted, as to contain a large amount of nourishment in a small bulk. This, I conceive, can be accomplished in the following manner:—Take a pound of meat, carefully separated from fat, chop it as fine as possible, (like mince-meat,) pour upon it eight ounces of cold or lukewarm water, (the temperature *must not exceed* 100° F.) and mix it well; let it stand an hour, stirring it three or four times; press out the fluid, which will amount to about six ounces; upon the meat pour again another eight ounces of cold or luke-warm water, and mix well as before; let it stand half an hour, occasionally stirring; press again and the fluid will this time be eight ounces; then place the apparently dry meat, broken up, in a small tin vessel, and set it in a water-bath containing cold water, heat the water of the water-bath gradually to the boiling point, and keep it boiling about twenty minutes. About six ounces of fluid will by this means exude from the meat. Mix the three fluids so obtained together; add salt, spices, or other flavoring materials, and boil for about twenty minutes in a covered vessel. The result is a thick fluid of a very peculiar appearance, from the coagulation of the albumen, which is extracted by cold water. But this albumen, from its being in small flakes or granules, must be easily digestible, and it represents a large amount of nourishment which is lost in every method of making soup, and, indeed, always where soup is boiled and strained, still further to enhance its nutritive power, and to thicken it, the addition of about one ounce of the semola above described may be recommended.

"It appears to me highly desirable at all times to distinguish this preparation of meat from soups or broths; it has a peculiar physical appearance, and the profession will at once perceive its special applicability to cases where a large amount of nourishment is desired to be given in a small compass, in a fluid form—conditions certainly wanting in the usual way of preparing liquid animal food. On these considerations would it not be well to give it a distinct designation? I venture to propose for it the name of *Trophazome*, and we might then speak of beef trophazome, chicken trophazome, &c.

"The diet of invalids is a subject of deep interest to the profession; and as there are several points of view in which it belongs to the chemist to study it, I hope to pursue the inquiry; and I shall feel much pleasure in continuing these communications.

"Conduit-street, March, 1850."

PROCESS, BY MEANS OF WHICH, ALL THE METALS MAY BE OBTAINED IN A SINGLE OPERATION IN CHEMICO-LEGAL INVESTIGATIONS.*

BY M. H. GAULTIER DE CLAUBRY.

THE numerous investigations made during the last thirty years on the processes for

* *Journal de Pharmacie, Feb.* 1850.

detecting poisons, even in extremely small quantities, have led to valuable results, by which justice and humanity have profited in a great number of criminal questions.

It cannot, however, be disguised that much remains to be done before the chemist will be able, with all the certainty desired, to discover in suspected products the poisonous matters they contain.

Leaving aside organic poisons, in respect to which, difficulties of a very peculiar nature present themselves, when it is required to demonstrate the existence, and, as is now indispensable, to exhibit a metallic poison, other difficulties present themselves, which the efforts of all those who have specially occupied themselves with works of this kind, have hitherto only imperfectly overcome.

If, in researches of this nature, we had at our disposal such quantities of products that it would be possible to repeat several times unsatisfactory experiments, we should be much less pre-occupied with the processes to be put in practice; but the quantities of matters on which we are required to operate are always limited, and not only must we be able to satisfy justice by extracting from the portion operated on, the poisonous matter sought for, but some must be preserved in case of a counter investigation. It is, therefore, necessary to act in such a manner as to obtain, without any bungling, and from only a portion of the suspected matters, the poisonous substances which they contain.

The presence of natural or altered organic matters, in which the poisonous substances are found, modifies the character of the latter so much, that serious errors would result from researches made under their influence; all the efforts of the chemist tend, therefore, to remove them, or to annihilate their action. The works of those who have been most particularly occupied with this kind of study, prove how numerous and various are the difficulties which must be surmounted.

When suspected products are sent to chemists, with indications relative to the nature of a poison, they have only to occupy themselves with the means of extracting it with the least possible loss; but the data prior to the investigation are rarely so positive that their researches can be confined only to the extraction of that poison. Besides, these indications being more or less inaccurate, it is not uncommon to meet with mixtures of various poisons, and, in all cases, it is important to ascertain if the substance suspected, really be the only one contained in the products.

However, we are rarely in doubt as to the nature of products used in poisoning, and however slight the indications collected by justice, the chemist derives real advantage from them in his investigations, by diminishing, as much as possible, his preliminary tests, and also, as far as possible, arriving directly at the process for extracting the poison.

The investigation of poisonous substances of the organic kingdom at this moment, presents very great difficulties, either because frequently less well characterised than those of the mineral kingdom, and acting often in extremely small doses, it is more difficult to separate them from the matters with which they are mixed; or because their alteration by the vehicles or reagents employed may cause them to disappear in the midst of the very operations undertaken to determine their presence.

I am somewhat confident of being able soon to present to the Academy a work which will lead, as regards organic poisons, to results analogous to those which I now have the honor of submitting to it, in relation to metallic poisons; but the researches which I have yet to make deter me from treating of this subject on the present occasion.

It is absolutely useless to dwell here on the details relative to the investigation of products which may be recognised by their physical characters. This research will always be necessary, whatever may be the processes to be followed for discovering the poisonous matters in a state in which the eye cannot perceive them, and should always precede the employment of vehicles or reagents, which would physically alter the products.

Poisonous substances being soluble in water or in alcohol, it is always important to submit the suspected products to the action of these vehicles; but the treatment of them ought to be confined to this, and if the aqueous or alcoholic solutions do not furnish positive results as to the nature of the poisons, they must be evaporated and united with the residue, which should be operated on by the process we are going to describe; no reagent which contains one of the substances sought for must be added, and in no case must animal black be employed for the coloration of liquids, since, as proved by the investigations of many chemists, it removes some salts, which are thus lost in the operation, unless afterwards sought for in the charcoal itself.

It will be evident from these details that the process which I propose does not in any way modify those which a chemist should follow, when he possesses no positive data as to the nature of a poison, and when he is forced to look for all that the products on which he operates, might contain.

In the present state of things, after the

investigations founded on the action of the various vehicles, the chemist is forced to recur to the employment of different processes, according to the nature of the metallic products, which it is required to recognise; for, with the exception of arsenic and antimony, for which he might make use of the same mode of destroying the organic matters, he must apply peculiar modes to the different metallic poisons, which might have been swallowed.

I do not consider it necessary to notice at length the inconveniences of this mode of operating: it may not, however, be useless to anticipate an objection which some people may raise, who would, perhaps, think that the employment of a single process for detecting all the metallic poisons will reduce chemico-legal investigations to a simplicity not commensurate with the importance of the subject.

Without any doubt, greater skill in the delicate manipulations of chemistry was required when it was necessary to make use of as many processes as metallic substances might be found in the respective substances, than when a single means might be applied for detecting them all; without doubt, also, treatises on chemical jurisprudence will be singularly reduced, when it is necessary to make known only one process, whereas it was necessary to describe a great number; but should we be permitted to regard such considerations when the sole object of the investigator should be to furnish to justice the light expected from his knowledge, and to the defence the means of exculpating an accused person!

Whether the suspected products have or have not been subjected to the action of water or of alcohol—whatever their state of solidity or softness—whatever their nature and the mixtures they may contain; without alluding to their dessication, their division or their mixture with some solid matter, as in the process of destruction by nitrate of potassa for example, whose proportions should be determined with care, because in two different ways the excess of mixed matters presents serious inconveniences, or in sulphuric acid, in which it sometimes divides with difficulty; they are submitted directly to the vehicle proper for destroying the organic matter, and presenting in the state of solution the metallic compound arising from them.

The employment of hydrochloric acid or chlorine with this object, has been proposed and adopted with more or less success. Without stopping to discuss the advantages or inconveniences of their employment, we may say that the alteration is always more or less difficult, and that a very great portion of the organic matters resists the altering action.

We know, from numerous facts, how much more easily a body acts in the nascent state than in the state in which it is presented to us; it is precisely in this nascent state that chlorine may be used for the object of which we treat.

We need not here study the actual nature of the products arising from the reciprocal action of the hydrochloric and nitric acids: the only thing that interests us is to turn this action to account.

Now, if any organic matter be introduced into fuming hydrochloric acid, excepting fatty matters, which are altered only with much difficulty, and if without heat, or after having raised the temperature according as the products are more or less alterable, concentrated nitric acid be gradually added, there arises, with a slight elevation of temperature, an altering action, which very soon makes them completely disappear, with the exception of fatty matters, a transparent and slightly colored solution is obtained, on which we may afterwards operate with the greatest facility.

The stomach, intestines, liver, vomited matters, excrementitious matters, blood, urine, wine, milk, earth of cemeteries, &c., are equally subject to this mode of treatment, which requires no particular care, so that the operation is made with as much facility as dissolving a metal in an acid.

In the case in which the poison is arsenic and the operation is slowly conducted, the distilled products do not contain any of that metal; however, as a portion of chloride might be volatilised, and as the disengagement of the chlorine and of the portion of acid which distils over requires some means of condensation, so as not to be troubled with their diffusion in the laboratory, it is always convenient to operate in a retort furnished with a tubulated receiver. When the operation is terminated, the condensed liquid is set aside to be treated as we shall direct further on. A tubulated retort, in which are introduced first the hydfochloric acid and the suspected matters gradually, until well disorganised, and finally, the nitric acid, suffices for the operation.

If certain that arsenic did not exist in the suspected matters, and if we had not to protect ourselves from the acid vapors and from the disengagement of chlorine, we should operate in a matrass.

In this way we do not experience the difficulties which the employment of sulphuric acid for the destruction of organic matters presents; the product remains perfectly liquid.

When the matters are well disorganised,

nitric acid is gradually introduced, and a gentle heat is continued, when, by the addition of this acid, the organic matters have disappeared, nothing but the fatty bodies remaining, we decant, wash the latter several times with distilled water, melting them each time, and mix the washing waters with the principal liquid.

After this, the investigation of the metals is extremely easy; it may be effected by various means.

If it be desired to precipitate them with hydro-sulphuric acid, the nitric acid must be driven off by boiling the liquor with an excess of hydrochloric acid until chlorine ceases to be disengaged, and then we have only to seek for zinc, which might be found in the liquor or the metals not precipitable by hydro-sulphuric acid.

If it be intended to make use of Marsh's process, the liquor must be saturated with pure potassa, and after decomposition with sulphuric acid, to drive off the last traces of nitric acid, we operate in the ordinary way.

I have made use of another process, which appears to me to present important advantages, and whose execution is easy: it consists in the precipitation of the metals from the solution by means of a galvanic current. The following is the mode of operating:—

After having concentrated the liquors to a point which experience will soon teach, to drive off the excess of acid, two platinum plates are steeped in it, or a single plate forming the cathode of a constant battery, Bunsen's for instance, and another of zinc—if this metal be not the one sought for, tin or platinum, in the contrary case, forming the anode.

After a time, varying in length according to a host of circumstances, but which does not exceed 8 or 10 hours in the most unfavorable conditions, the platinum is found to be covered with a deposit formed of the metal or metals contained in the solution: after having washed this plate by means of a washing bottle, it is treated with nitric acid, with or without heat, and a solution of the metal or metals is obtained, on which we operate with the greatest facility on account of the small bulk of liquid which has been obtained.

Infinitesimal proportions of the various metals may thus be detected, and it is evident that the same process applies to all, except silver, which we seldom have occasion to seek in cases of poisoning; and zinc, for which it is necessary only to employ platinum or tin as the cathode of the battery.

Although very sparingly soluble by itself, chloride of lead dissolves sufficiently readily in an excess of hydrochloric acid for all the lead to be found in the liquor.

If the presence of arsenic were suspected in the products examined, the liquids condensed in the treatment with nitro-hydrochloric acid must be saturated with pure potassa, and after having concentrated the solution to a suitable degree, it is mixed with that of the organic products.

In no other case need we trouble ourselves with the volatile products.

I think it useless to describe here the numerous experiments I made in the study of this process, which, in the hands of chemists, will present no difficulty in its application.

The chemist, in a case of chemical jurisprudence, is not only called on to enlighten the investigations of justice in cases of poisoning; he has frequently to make researches, the object of which is to prove the employment of substances which may be found in insufficient quantities to act as poisons, but which it is important to prohibit on account of the accidents to which they may give rise; for example, the addition of sulphate of copper to bread.

It is known that bakers, with a fraudulent motive, have sometimes introduced into bread extremely small quantities of sulphate of copper; it is also known that the incineration of charcoal from bread takes a very long time: the treatment by the process which I have described is extremely easy and rapid; it allows of operating in a very short time on a very considerable quantity of bread, and of multiplying the experiments, and leaves nothing to be desired in point of accuracy.

When it is required to seek for zinc in bread or other organic matters, and when carbonisation is resorted to, it is always to be feared that a portion of the metal will volatilize; by treatment with nitro-hydrochloric acid, to ease in operation is joined the certainty of losing no portion of the product.

I think that it is not necessary to mention all the other circumstances in which the new process will be applicable; I have not yet met with any in which I have been unable to make use of it, and hence I may be permitted to think that its adoption may render true service to chemists called upon to make investigations of this kind.

An objection may be raised against the employment of this process, which has already been opposed to some others, in which hydrochloric acid is employed, namely that it may contain arsenic. There is only one reply to this: as we can obtain pure hydrochloric acid, that alone must be employed. Sulphuric acid also often contains more or less of that metal. Sulphuric acid,

which does not contain it, should alone be used.

In order not to be regarded as a plagiarist, as regards Dr. Abreu's investigations, I must here give a brief explanation as to the date at which I devoted myself to investigations concerning the process which I have the honor of communicating to the Academy; it will leave no doubt on the subject.

On the 1st of April, 1844, I presented to the Academy, in a *paquet cacheté*, which it was kind enough to receive, the description of the process which I have just described in this memoir: particular circumstances, which it is useless to mention here, and my desire to make myself certain of its advantages by repeated trials, have prevented me from publishing them sooner; but the dates prove that I have borrowed nothing from Dr. Abreu, and that long before him I had applied a means which appears to me more advantageous than that which he has proposed, and which, after all is only Millon's process employed in other conditions; this process relates, moreover, only to the destruction of organic matters, and not to the separation of metals from solutions containing them.

ON THE BALSAMS OF PERU AND TOLU.*

BY M. GUIBOURT.

THE balsamic juices known by these two names, are produced by trees belonging to the genus *myrospermum*, of the family of *papilionaceæ*. The different species of this gum are not all well determined, but the following are generally admitted:—

I.—*Myrospermum frutescens* Jacq. This species is distinguished from the others by its upright stamens, and its pod, which appears to rise abruptly from the calyx. The tree is low, the leaves are brittle, composed of from eleven to fourteen alternate leaflets, smooth, of an oblong elliptic shape, entire, rounded, and crenated at the top; the resinous juice which fills the pod, according to Jacquin, has a strong and disagreeable odor. It is said that this tree is very abundant in the neighbourhood of Carthagena, in Columbia, and on the eastern slope of the mountains in the Caracas. I cannot however, assign to this species any of the products found in commerce.

II.—*Myrospermum peruiferum* D. C.; *myrospermum pedicellatam* Lam. This myrospermum is a large tree, the trunk of which, covered with a thick, uneven grey bark, attains a diameter of 65 centimetres. The wood is whitish towards the outside, but of a brownish red towards the centre; very hard, and much esteemed for building houses and sugar-mills. The leaves are composed of from seven to fifteen alternate leaflets, oblong-ovate, entire, some a little pointed, but all crenated at the end; these leaflets are from 27 to 45 millimetres long, and from 16 to 23 broad, green, firm and tough. The fruit is a pedunculated pod, smooth, yellowish, linear, much flattened and membranous along its whole length, which varies from 5·5 to 11 centimetres, except at the end, which has an oblong, uneven swelling, containing only one pale red, reniform seed. This tree grows in Peru, where it is called *quino-quino*, and whence specimens were brought by Joseph de Jussien. The form of the leaflets appears to vary; for Ruiz has described them as ovato-lanceolate and pointed, although the end is always rather obtuse and indented.*

According to Ruiz the balsam of the *quino-quino* is extracted by incisions made in the bark, early in the spring; that is to say, when the rains are short and frequent. When it is caught in bottles it will remain liquid for years, and is then called *liquid white balsam*;† but when enclosed in gourds, as is commonly the practice at

* *Journal de Pharmacie et de Chimie*, March, 1850.

* The *myrospermum peruiferum* of Ruiz, the description of which is unfortunately wanting in the *Flora of Peru*, grows in the mountains of Panatahuas, in the woods of Puzuzu, Muna, Cuchero and others near the course of the Maraguon. That which Dr. Weddell found in Bolivia, has leaflets similar to those described by Ruiz, all being oblong-lanceolate, and terminated by a blunt point, a little cloven. The contour of the leaves is slightly undulated, and the edge, placed between the eye and the light, appears to be riddled with spots and small transparent lines, placed parallel to the secondary veins. The largest veins are 44 millim. long by 20 broad, the smallest are 32 millims. by 15.

The wood of this same tree, brought by Dr. Weddell, is aromatic, very hard, compact, and of a beautiful red color; the sap is yellowish, and not very thick; the bark is whitish, uneven, cracked, impregnated with a resino-balsamic juice.

†This white and liquid balsam of Peru, has perhaps never been seen in commerce. According to Lemery, what was given under this name, in his time was *liquidambar* balsam.

Carthagena and among the mountains of Tolu, it after some time hardens into a resin and receives the name of *dry white balsam*, or balsam of Tolu, by which names it is known amongst pharmaceutists and druggists.

III. *Myrospermum pubescens* D. C. *myroxylum pubescens* Kunth. Alternate leaves, petiolate, composed of 10 to 13 alternate leaflets, with short stalks, occasionally nearly opposite at the extremity, oblong or oval-oblong, the point obtuse, and notched, rounded and sometimes slightly cordiform at the base, very flat, etc.

The centre vein and original stalks are hairy and brownish; the leaflets are from 60 to 70 millimetres long by 23 to 29 broad; the pendicles of the stamens are brittle. The fruit is similar to the foregoing, from 9 to 10 centimetres long and from 18 to 20 millimetres broad. This tree is cultivated in the neighbourhood of Carthagena and in the province of Popayan.

The *myrospermum peruiferum* of Lambert, which is made synonomous with the *pubescens*, is larger. The leaflets are from 7 to 10 centimetres long by 4 broad, and the fruit is from 12 to 14 centimetres long by 3 broad. I think that the *hoitziloxitl* of Hernandez (*Mex.* p. 51), of which the appearance is almost exactly like that of the *cinchona*, is similar to this species. According to Hernandez. at whatever time of year they make an incision in the bark, but especially at the close of the rainy season, they obtain thence that noble *Indian balsam* which cannot be sufficiently praised, which is liquid, of a dark reddish color, of an acrid, rather bitter taste, with a powerful but pleasant odor.

IV. *Myrospermum toluiferum* D.C.; *Myroxylon toluiferum* Ach. Rich. and Kunth. A very large tree, the wood of which is red in the centre, and with an odor of balm or rather of roses. The leaves are composed of 7 or 8 alternate leaflets, with short stalks, acuminated, smooth at the edge, but wavy, reticulated, veiny, membranous, very smooth and bright, sprinkled with small transparent lines and spots. The terminal leaflet is 80 centim. long by 34 broad; the intermediate ones are from 63 to 77 millim. by 25 to 27; the lowest, which are likewise the smallest, are 54 millims. long. The flowers and fruits are unknown.

The *myrospermum toluiferum* grows in the neighbourhood of Turbaco, and chiefly on the high savannahs, near Tolu, Corozol, and the town of Tacasuan. This tree was named by Linnæus *toluifera balsamum*, and was placed by Jussieu in the family of Terebinthaceæ, in consequence of an error of Miller's, who had joined to the description of the leaves a fruit unknown to the species. Ruiz was the first who considered that the *toluifera* of Linnæus should be united in one genus with the *myroylon* and *myrospermum*. This celebrated botanist likewise thought, as above mentioned, that the balsam of Tolu was the same as the dry balsam of Peru. The first opinion has been confirmed by M. Ach. Richard; the second is likewise very near the truth.

BALSAM OF TOLU.

This balsam is produced in great quantities in the parts of Columbia already spoken of in connection with the *myrospermum toluiferum*. It is *dry* or *soft*.

The *dry balsam of Tolu* used to come over in small gourds, which are now very rare; afterwards it came in earthen pans of considerable weight and size; now it is almost exclusively brought in tin boxes of about 3 kilog. in weight. When cold, it is solid and brittle, but easily runs and becomes a homogeneous mass, like pitch. It is fawn colored or red, partially transparent, and of a grainy and crystalline appearance. It has a soft, sweet odor, not so strong as that of storax and balsam of Peru. It is easily bitten, and has a soft perfumed flavor, accompanied merely by a slight acritude in the throat, due to the cids which it contains. It melts in the fire, diffusing a very agreeable odor; it is very soluble in alcohol, less soluble in ether. Boiling water extracts from it a considerable quantity of mixed cinnamic and benzoic acids.

The *soft balsam of Tolu* is always brought in tin boxes; it has the consistency of soft pitch or thick turpentine; it is more transparent than the former, deeper in color, and often contains impurities. It has a sweet and aromatic odor, perhaps rather stronger, with a less powerful taste, and contains less of the benzoïc and cinnamic acids. I am convinced that this difference is because the balsam is newer; in fact, by exposing this soft balsam to the air on a plate, it solidified, without losing in weight, and, having treated it with water, I found, by means of saturation with alkali, that the balsam dried in the air contained more acid than when it was newer. It is evident that this additional acidity is owing to the oxidation of the essence.

DRY BALSAM OF PERU.

We have already seen that, according to Ruiz, the *myrospermum peruiferum*, at least that which he thus names, furnishes, by incision, a liquid and whitish balsam, which, when solidified in the air or in gourds, has the name of *white dry balsam*

or of *balsam of Tolu*. I am indebted to Dr. Widdell for a sample of this real dry balsam of Peru, collected by him in the south of Bolivia, at the foot of the *myrospermum*, of which he brought the leaves and wood. This balsam is quite solid, of a reddish white, translucid, hard, very viscid, and jagged or crystalline when broken. It has a very aromatic odor, analagous to that of ordinary balsam of Tolu, but much stronger, although still very agreeable; it softens between the teeth and has the same perfumed flavor, accompanied by a perceptible but not unpleasant sharpness. In one word, the dry balsam of Peru and the balsam of Tolu should be considered as two sorts of the same substance, of which the first is far superior in quality to the second.

BROWN BALSAM OF PERU.

Balsam of Peru in cocoa of the third edition of *L'Histoire des drogues simples*. I still leave the name of *balsam of Peru* to this substance, although I have reason to think that it comes originally from Brazil, and that it is the same as the *caburéicica* of Pison (*Bras.* p. 57), produced by the *caburéiba*, an immense and very aromatic tree with small leaves, similar to those of the myrtle growing in the districts of Saint-Vincent and Santo Spirito, as well as in the province of Pernambuco. I think so because M. Fr. Ph. Martius tells us that this balsam, which is of an extraordinary fragrance and similar to that of Peru, is enclosed by the Indians in the unripe fruits of a species of *eschweilera* or *lecythis*, and that the fruit in which the brown balsam of Peru is usually enclosed, which I formerly took for a small cocoa, is in reality the fruit of one of the lecythidœ. However it may be, this balsam is semi-fluid, clotted, and of a very dark color. It is not transparent, unless, indeed, when thinly spread on a piece of glass. It seems to be formed of two different matters; one fluid, the other clotted and rather crystalline. It has a very sweet perfumed flavor, and has a strong and most delightful odor, approaching much to that of dry storax.

This balsam is likewise brought in gourds like the balsam of Tolu; I have one of this kind, 9 centimetres high by 7·5 broad, half full of a balsam some of which still runs a little, homogenous, smooth, transparent, and of a red brown; whilst the remainder presents a mass of small sparkling crystals, impregnated with the former substance. These crystals have no acrid taste and should contain no benzoïc acid; the gourd enclosed in a matrass soon covers it with a white sublimate, which renders it quite opaque.

BALSAM OF SAN SALVADOR.

Black balsam of Peru or Liquid balsam of Peru of commerce. It was long thought that this balsam came from Peru, and that its sole difference from the foregoing proceeded from its being obtained from the branches of the tree by decoction in water. But, in the first place, a balsam obtained by decoction in water, instead of being more liquid and more aromatic than that procured by incisions, would be thicker and contain less volatile oil, the contrary to which is the case. Secondly, this balsam should not contain either cinnamic or benzoïc acid, and the black balsam of Peru contains a great deal; thus, this balsam is not obtained by decoction.

On the other hand, a French druggist long resident at Lima, *has never seen black balsam of Peru*, and two travellers who have been all over La Paz, to seek quinquinas, have neither seen balsam, nor fruit similar to that of the *myrospermum*.* These two circumstances made me doubt strongly that the black balsam of Peru (or the other either), came from Peru, when a French merchant, (M. Bazire), returning from the Republic of Central America, sent me some of this same balsam, which is obtained in abundance on the coast of San Sonata, in the state of San Salvador, by *incisions* made in a *myrospermum* of which he sent me the fruit. This fruit, which I have described in the *Journ. de Pharm.*, t. XX., p. 552, wanted the membranous wing which distinguishes the *myrospermum*, and I made myself certain, by examining the edges of the fruit, that this absence was not accidental; but the drawing of the tree which I have since seen in Hernandez, (Mex. p. 51), has shewn me that it does not differ in this respect from the other *myrosperma*, and it is probably the same as the *M. peruiferum* L. However that may be, there can be no doubt but that the supposed *black balsam of Peru* is the same as the *Indian balsam* of Hernandez, to which I consider that I restore its real name by calling it *balsam of San Salvador*. I have then been much astonished by seeing that M. Recluz has this year published as new, in the *Journal de Pharmacie* (Aug. 1849), what I said in 1834 as to the origin of this balsam. I should have made no observation about it, had not M. Recluz at the same time reproduced as new, an error of Jacquin, repeated by many botanists, who have even placed it amongst the distin-

* Nevertheless, this tree does exist, for it has been seen.

guishing characteristics of the genus *myrospermum*: namely, that the seed-vessels and the seeds themselves are full of balsamic juices, whence Jacquin has even formed the generic name *myrospermum* (seed-perfume), and whence Chaumeton at first, but doubtfully, in the *Flore Médicale*, and afterwards M. Recluz, without hesitation, have supposed that the balsam of Peru was drawn from the seeds and not from the trunk or thick branches of the tree. Now, the seeds of the *myrospermum* are formed of a membranous white and very thin episperm, and two yellowish cotyledons, oily, and with a faint scent of melilot, which contains no balsam whatever; *the pod itself is completely without*, and it is only outside the endocarp, and in several cavities formed by the mesocarp, that we find a small portion of resinous yellow and transparent balsam, liquid when new, but dry and brittle in the fruits obtained in commerce. It is impossible that this small quantity of resinous juice should have been the origin of that of commerce; and besides the united authorities of Hernandez, Pison, Ruiz, and Humboldt, as to the balsam of Tolu, M. Bazire as to that of San Salvador, and of Dr. Weddell as to that of La Paz, leave no doubt as to the fact that *all these balsams come forth naturally, or by means of incisions*, from the trunk of the trees which produce them. I now return to the balsam of San Salvador.

This balsam is of the consistence of boiled syrup; it is transparent and of a very dark red-brown color; it has a strong odor, somewhat similar to that of liquid storax, but very agreeable, and the taste is almost *insupportably acrid and bitter*. It burns with a flame when hot, and dissolves entirely in alcohol; but the liquor is always cloudy, and deposits a small quantity of a fawn-colored, pulverulent matter; it yields an acid to boiling water, and sometimes contains sufficient to form in it after a time beautiful crystals in needles and prisms at the bottom of the bottles containing it; it is employed in several pharmaceutical preparations and in perfumery.

The black balsam of Peru is often adulterated with rectified alcohol, different fixed oils, balsam of copaiba, etc. Rectified alcohol may be known by the diminution which the balsam will sustain after being mingled with water; the fatty oils, except castor oil, may be discovered by dissolving the balsam in alcohol; copaiba will be known by its odor; in general, the purity and strength of the odor, and the perfect transparency of the balsam, are sufficiently certain proofs of its goodness.

ON SALEP.*

BY DR. X. LANDERER.

THE enormous quantities of salep root which are every year brought from Macedonia, chiefly from Janina, to Greece and the whole of the East, induced me to obtain some information respecting this important substance.

In all parts of the kingdom of Greece, but particularly in the plains between Nauplia and Argos in Messenia, many sorts of orchis are found, and amongst these, *orchis pyramidulis*, on hills in Messenia and Lukania; *orchis mascula*, on the Parnassus, in Arcadia, and in Argolis; *orchis longiflora* and *O. variegata*, in all parts of the Morea; *O. undulatifolia*, in Messenia; *O. sambucina*, in Elis; *O. nigra*, *O. maculata*, *O. conopsea*, in the Islands, etc.

From all these species the tubers are carefully collected; but, on account of their disagreeable odor, and the mucilagenous and unpleasant taste of the decoction, they are very little used, so that only the poorest class of the inhabitants gather and employ them for domestic purposes. The Grecian salep is not an article of commerce —commercial salep comes from Macedonia, from the fruitful valleys and the evergreen mountains about Janina, from Sagona, Tempe, etc.

The species of orchis found in these parts of Epirus, are *O. pyramidalis*, *O. mascula*, and *O. morio*. Without the least attention or care having been paid to the culture of these plants, extensive tracts of lands and mountains are seen at the commencement of the spring, in the months of February, March, and April, covered to the top with orchis plants. This luxuriance is said to be principally caused by the annual digging up of the soil. The more severe the winter has been, and the more snow that has covered the mountains during the winter months, the more abundant is the salep crop; it is also stated to have been observed that a larger consumption of these roots is followed by a large produce of them, as the people are thus compelled to turn up the soil, by which the developement of the small tubers is much promoted.

After the inflorescence, namely in April and May, the crop begins, and lasts until August. For this purpose, the soil is turned up to the tops of the mountains, the tubers picked out, and the ground again made flat. The tubers are now repeatedly washed in running water, and the smaller separated from the larger ones. The first

* *Pharmaceutical Journal*, March, 1850.

are strung on thread by women and children, and quickly dried in the sun. The tubers which come from these parts to Greece, are scarcely as large as a pea, and are generally of a much darker color than those which are not strung upon thread, which are sold for double the price. These latter are said to retain their white color by being quickly dried in a baking oven, by which they acquire a horny character, which is imparted to them by merely quick drying, and not as stated in pharmaceutical works, by being previously dipped into boiling water. Whether this immersion be customary in Persia or not, I cannot say with certainty; the Saleptsides in Constantinople, who import their salep from Persia, do not mention anything of the kind.

Some roots possess a somewhat saline taste, which proceeds however, not from their having been dipped into salt-water or sea-water, but from the soil in which they grow; for the various sorts of orchis thrive very well on the coast. The salep imported from Persia, which is sold in the bazaars of Smyrna and Constantinople, and which is at the same time distinguished for its whiteness and corneous appearance, is particularly said to have a very salt taste. In the East, however, where the consumption is the greatest, this sort is not liked, and therefore the Macedonian kind is preferred.

The collectors pay particular attention to those plants with blue blossoms, as they consider the root to be "the male salep," which, in their estimation, possesses a greater medicinal power; and is, on this account, sold much dearer. When the bulbs are perfectly dry, they are placed in sacks and sent to the East for sale.

The salep is in great repute among the Turks as a strengthening medicine, and is used throughout Greece, in affections of the bowels and respiratory organs. The decoction of salep, or rather the gelatine salep, is prepared in the following manner, by persons who are called in Greece, and in the whole of the East, *saleptsides*:—

The salep is ground in hand-mills into a fine powder, then stirred up with water, and boiled into a stiff jelly, which is sweetened with honey. Some saleptsides add also a small quantity of cypress root, in order to make it slightly acrid.

After midnight, these men go to work, and with daybreak they are heard crying, "*salep, salep sesion!*" *i. e.* hot salep, which is taken against coughs., &c, not only by the poor, but by others. The salep jelly is carried about in large tin vessels, and kept hot by coals underneath. About eight o'clock in the morning, the whole troop of these saleptsides disappear all at once, and betake themselves to their huts, in order to issue again thence with the following daybreak.

ADULTERATION OF DRUGS AND CHEMICALS.

NO. II. THE PIGMENT CARMINE.

THIS is an article kept for sale in almost every druggist's shop. I am sorry to find that I cannot purchase the pure article at all! Out of a scruple I bought, I had the mortification to find that nearly two-thirds of its weight was vermillion! This seems to be the fixed proportion in samples I got from at least a dozen places, and I have no doubt but that all the rest in the town was equally bad. This is really a villainous imposition, and has very likely been carried on for a length of time; for the cheat is not likely to be detected by the class of persons who most use it,—the greater part of it being sold as a cosmetic for ladies.

The fraud however may be detected easily, by adding the suspected article to a solution of common soda, and boiling the mixture in a phial for about a couple of minutes; allow the phial to cool and remain undisturbed for about an hour, at the expiration of which time you will find the vermillion settled at the bottom in a pretty thick layer.

How is it that such frauds are allowed to exist?—is there no remedy for such evils? I trust that some scheme will be devised shortly to stop the game, for it has evidently had a good long run. The adulteration of such a costly article as carmine, to the extent generally found, must be a coining affair; and if it should happen to be done by the makers or importers themselves, they must by this time be provided with tolerably long purses.

I have he honor to be,

Yours truly,

T. W. N.

NOTE ON THE DISTINCTIVE CHARACTERS OF THE RHAMNUS CATHARTICUS AND RHAMNUS FRANGULA.*

BY M. MOLYN.

NOTHING is more the order of the day than fraud. Every day this abominable practice invades our art more and more. It is not only in medicines of high price

* *Journal de Chimie Medicale*, Mar. 1850.

that the adulterator speculates; the commonest substances are sophisticated; the most simple plants, and which every one thought safe from adulteration, have their substitutes. If a matter presents any resemblance to another, even when it possesses entirely contrary virtues, it is substituted for the latter, when men who devote themselves to such vile speculations find, however little, profit in them.

M. Molyn having found that the berries of *rhamnus frangula* were sold for those of *rhamnus catharticus*, gives the following characters for distinguishing them; for the resemblance of these fruits is so perfect, that a simple external inspection might deceive the most practiced eye.

The berries of *rhamnus catharticus* are black at their maturity; they are of the size of a pea, and are sometimes compressed by being so thick, owing to their great number. They contain from two to four seeds, according to some authors; but, in examining them, M. Molyn has commonly found four; seldom less. When one of these berries is squeezed between the fingers, a pulpy juice flows out, of a blackish-purple color, which becomes green in drying; its taste is bitter, nauseous, and the seeds, which are of a blueish-brown color, and of oval form, float in the inside; they are flattened on one side and indented on the other, terminating in a point. Their size is that of large anniseed. The maturity of these fruits is ordinarily attained towards the end of September and in October.

The berries of *rhamnus frangula* are likewise black at maturity; they are of the size of a pea. When one of these berries is compressed between the fingers, there likewise flows out a pulpy juice, of a blackish-purple color, which, in drying, does not turn so green as the foregoing; its taste is sweetish and styptic. In this juice float two seeds, very rarely more, of a yellowish-white color, of a flattened round form, and of the size of a lentil. These berries are ripe at the same time as the foregoing.

ALARMING RESULTS OF THE USE OF CHLOROFORM.—REMEDY BY INSUFFLATION.

*To the Editor of The Lancet.**

SIR—After reading the case of death from chloroform published in *The Lancet* a few weeks since, by Mr. Solly, it was my intention to have sent you the following. Having omitted to do so, I now offer it, as confirming the treatment recommended by M. Ricord, in his letter, copied into your last number. On July 3rd of last year, I removed a large schirrous breast from a strong, stout woman, Mrs. K——, aged forty-two, the wife of a plumber, of this town. It was her wish that she should be put under the influence of chloroform, which was accordingly done. For several minutes her system resisted the influence of the remedy, and it was not until three drachms were used, and the vapor concentrated by placing a fold of lint over the back of the inhaler, that she was rendered unconscious.

The removal of the breast occupied about four minutes, during which she showed not the slightest consciousness of pain, or of what was going on; just as the last incision was completed she slipped from the chair in which she was sitting, and from the grasp of an athletic woman, who was holding her, and fell, apparently dead upon the floor; her face was of a deadly pallid and livid color, and her lips, lobes of the ears and finger-nails of a deep purple hue; her eyes were fixed, pupils rather dilated, irides motionless; her limbs relaxed and perfectly still; no pulse to be felt at the wrist or carotids; and on placing my ear upon her chest, not the slightest sound of the heart's action or respiratory murmur was audible. The window was thrown open, and cold water, ammonia, etc. called for. I immediately perceived that these would avail nothing, when it occurred to me that artificial respiration, by direct insufflation,—in the way, indeed, in which I have always used it for resuscitating still-born children, and which I learnt from my midwifery preceptor, the late Dr. Hugh Ley,—might possibly save her. Intervening a single fold of my pocket handkerchief, I placed my lips within hers, and breathed strongly into her mouth, at the same time closing her nostrils with the thumb and forefinger of my left hand, and pressing her larynx towards the spiral column with my right fingers and thumb, so as in some degree to close the œsophagus. At the fourth inspiration she gave a slight convulsive gasp, and this was followed by other and more regular respiratory efforts; her pulse returned, and her countenance soon resumed its natural color, and I had the delightful relief to see her revive. After a few minutes I proceeded to remove a diseased gland from the axilla; at this she cried out a little, though it was evident that the anæsthetic influence of the chloroform was still to a degree kept up, yet she was quite

* *The Lancet*, March 2, 1850.

conscious of what was being done. There had been but little hæmorrhage during the operation, and only one vessel required to be tied. She complained much of headache during the rest of the day, but went on favorably, and the wound soon healed. She has not shown any symptoms yet of a return of the disease. I was assisted in the operation by my friends, Mr. Frederick Seagram, of this town, Mr. E. B. Thring, of the Bengal Medical Service, and my own assistant. We all looked upon the woman as irrecoverably dead, and were as much surprised as gratified to see her restored.

I remain, Sir, your constant reader,

CHARLES BLEECK.

Warminster, Wilts, Feb. 26, 1850.

PRACTICAL OBSERVATIONS ON THE PREPARATION OF EXTRACT OF DATURA STRAMONIUM.*

BY M. AUGILLIS MORTIER.

M. AUGILLIS MORTIER proposes a modification in the preparation of extracts with certain green plants, whose critical portion is of a very resisting texture.

He prepared extract of stramonium, in the ordinary manner, namely, by evaporating the juice extracted from the green plant; but, being astonished at the small quantity of extract which he obtained, he treated the grounds of the operation by pouring on a sufficient quantity of boiling water to cover it, and straining after twenty-four hours' contact, and pressing. The liquid evaporated on a sand-bath furnished an extract of a blackish brown colour, of a powerfully green odor, and of a bitter taste.

In combining the products of the two operations, M. Augillis Mortier obtained from 5 kilogrammes of stramonium leaves 262 of extract, instead of 125 grammes, which is all he would have obtained by the former process.

The following are the conclusions which he draws from his experiments:—

1. That, notwithstanding expressure by the hand and with a press, the cartical substance of the stems of stramonium still retains a considerable quantity of extraction, probably because the pestle cannot reduce it fine enough for the mechanical action to make it flow out.

2. That probably it is the same in stems of belladonna and hyosciamus, which also have a cartical substance of a very resisting texture; and that it is favorable to treat them in the manner described above.

* *Journal de Chimie Medicale*, March, 1850.

ABSTRACT OF THE ANALYSIS OF A NEW SUBSTANCE OCCURRING IN THE URINE OF A PATIENT WITH MOLLITIES OSSIUM.*

BY HENRY BENCE JONES, M.D., F.R.S., PHYSICIAN TO ST. GEORGE'S HOSPITAL.

THE urine was passed by a grocer, forty-seven years of age, who had been out of health for thirteen months.

The specimen of urine was slightly acid; specific gravity 1034·2; it contained a sediment consisting of crystallised phosphate of lime, oxalate of lime, and cylinders of fibrine. The urine became thick with heat, but became clear on the addition of a drop of acid. It gave no precipitate with an excess of nitric acid, unless left to stand, or unless heated and then cooled, when it became solid. This solid was liquified by heat, and was again produced on cooling. Continued boiling with strong nitric acid evolved but little gas, and did not quickly hinder this reaction. Hydrochloric acid gave the same solid precipitate, soluble by heat. Strong acetic acid gave only a slight precipitate, which was redissolved. Caustic potassa and sulphate of copper gave a splendid bright blue, clear liquid, passing, when heated, to claret color. 516·84 grs. evaporated to dryness in vacuo over sulphuric acid, gave 48·37 grains solid residue = 93·58 per 1000 urine.

The urine was examined at various periods, and differed in coagulability, owing either to a variation in the degree of acidity, or to variations in the composition of the new substance.

The ultimate analysis of the new substance may be represented by $C^{48}H^{36}N^{6}O^{18}$; or by $C^{40}H^{31}N^{5}O^{15}$ according as protein is = $C^{48}H^{37}N^{6}O^{15}$; or $C^{40}H^{30}N^{5}O^{12}$.

Carbon	52·10	52 00
Hydrogen	6·7	6·85
Nitrogen	15·17	15·15
Oxygen	26·00	25·99
Sulphur	1·36-1·09 = 1·03	per cent.
Phosphorus	·19 = ·19	per cent.

Hence it is an oxide of albumen, and from the ultimate analysis it is the hydrated deutoxide of albumen.

The bones of the patient after death exhibited the changes indicative of the existence of *mollities ossium*. During life 66·97 parts of this hydrated deutoxide of albumen were passing out of the body in every 1000 parts of the urine,—as much as there is of ordinary albumen in healthy blood: so that an ounce of urine was equal to an ounce of blood lost.

* *Philosophical Transactions.*

NITRATE OF SILVER IN DYSENTERY.*

BY M. GUYON.

Nitrate of Silver	2 to 5 centig.
Water	30 grammes.
Syrup of poppy heads..	10 grammes.
Gum syrup	40 grammes.

1 spoonful every hour.

The first effect of this remedy, according to the author, is to ease the pain and to render the evacuations less frequent. This means appears to him especially useful in the gastric or bilious form.

INFUSION OF TEA AS A MEANS OF PREVENTING LOSS OF HAIR.

An infusion of tea has been found very useful in hot countries, for preventing the hair from falling off. The plan commonly adopted is to pour boiling water on the leaves after they have been used for a meal, and allowing them to digest for three or four hours. The liquid is to be poured off and used as a wash.

POISONED GAME.†

At Lavanne, in the neighborhood of Rheims, entire covies of partridges have been found dead in the fields. Chemical analysis of the undigested contents of their gizzards, has led to the detection of considerable quantities of arsenic in the grain on which they had fed. The arsenic had been employed to destroy vermin. The editors of *L'Union Médicale* observe that the occurrence of fatal poisoning in individuals, in England, who had partaken of game thus poisoned, should have induced Governments to have forbidden the employment of arsenic for such purposes.

POISONOUS EFFECTS OF MERCURIAL VAPOR IN A HOSPITAL.‡

The ward No. 8 of the Marine Hospital at Rochefort is one of the largest in the establishment. It measures about three hundred feet in length, by forty in width, and contains ninety-five beds, which are occupied by fever cases occurring among the galley slaves. Five, however, of these beds are appropriated to agents of police. During the summer of 1846 it was discovered, that notwithstanding the utmost care, and that the bedsteads were made of iron, the ward was infested with bugs to such an extent that the patients could get no rest. Owing to the crowded state of the hospital it was at that time impossible to take the requisite steps for ridding the ward of the vermin. It was not until the month of November that the patients could be transferred to another ward, and the thorough cleansing of the bedsteads, &c., be effected. These were then thoroughly fumigated with mercurial vapor, which had been found of great service in other wards, and had not been attended with any subsequent ill effects.

On the 13th December forty-three patients were removed to this ward. The day was cold, the thermometer standing at 30° Fah. in the open air, and in the ward at about 43° Fah.

When Dr. Lefevre visited the patients, thirty-nine hours after their return to the ward, many among them complained of heat of the mouth, tenderness of the gums, and salivation. On the following day the number of these cases had increased; and the ward was consequently evacuated. On the 18th it was found that thirty-nine out of the forty-three patients had been attacked by mercurial salivation. In some cases it assumed a severe form. Diarrhœa occurred to some simultaneously with the appearance of salivation. After the 19th no fresh case occurred.

The supervention of this mercurialization exerted no influence on the pre-existing disease of the patients. The accessions of intermittent fever returned with their previous regularity. The affections consequent on ague, and which were numerous at Rochefort, were in no degree modified.

Of the four men who escaped the salivation, one was suffering from acute tonsillitis, a second, from chronic hepatitis; the third, from quotidian ague; the fourth, from chronic bronchitis.

The five agents of police who were present as guard over the convicts, and who were not confined to the ward during the whole twenty-four hours, were not affected by the vapors. The sisters of charity, also, who breathed a pure air during the greater part of the day, escaped its influence.

It it impossible to ascertain the quantity of mercury received by each patient: it must, however, have been very small, from the warming and ventilation to which the ward had been exposed previously to the re-admission of the patients, and because from the lowness of the atmospheric temperature, the volatilization of the mercury which remained, attached to the walls, furniture, &c., would be retarded.

* *Journal de Chimie Medicale*, Mar. 1850.
† *London Medical Gazette*, Mar. 1, 1850.
‡ *Journal de Chimie Médicale*, 1849, and *Medical Gazette*.

After the evacuation of the ward it was purified from remaining mercury, by heat, chlorine, ventilation, whitewashing, painting, &c.

After three months, other patients were admitted without experiencing any ill effects except those which arose from the reappearance of the bugs in the summer months, and which again infested the beds as badly as at first, showing that the mercurial vapor had been powerless to destroy bugs, but powerful to injure man.

PREJUDICE AGAINST CHLOROFORM.*

We observe it stated that chloroform has been employed in Edinburgh in from 80,000 to 100,000 cases without a single accident or bad effect of any kind traceable to its use. Mr. Carmichael, a surgeon of that city, commenting on the fact, says—"Would 80,000 to 100,000 full doses of opium, or antimony, or Epsom salts, or any other potent medicine, have been followed with as great impunity?" Chloroform is now habitually used in Edinburgh in all kinds of surgical operations down to tooth-drawing. It saves many lives which otherwise would sink under the nervous shock which is experienced from a severe operation undergone in a state of consciousness.

The rejection of chloroform, because of a few fatal cases, seems to be no more rational than it would be to refuse to travel by railways because one person in several millions has been killed by a collision.

TOWNSEND'S COMPOUND EXTRACT OF SARSAPARILLA.

We have tried the effect of this medicine, and, we think, with advantage. It is a pity that advertisements are not more modest than they are sometimes.

We have much pleasure in giving our testimony, at his request, to the efficacy of Mr. Gavin's mode of filling decayed teeth.

BOOKS RECEIVED.

Outlines of Qualitative Analysis for Laboratory Practice. By Sheridan Muspratt, Ph. D. F.R.S.E., Professor of the Liverpool College of Chemistry. Taylor and Walton.

Descriptive Catalogue of Works in Science and General Literature, published by Taylor, Walton and Maberly.

* *Chambers' Journal.*

TO CORRESPONDENTS.

"An Investigator," (Brixton).—There is no depending upon the so-called "pure chemicals" of the ignorant pretender of whom you purchased the reagents used in your investigations; we attribute your result entirely to the impurity of the reagents you employed. We recommend your obtaining a fresh supply from some house of established respectability. We once found arsenic in "pure" sulphuric acid for which this humbug had charged 2s. 6d. per lb. He makes very few, if any articles himself, and as his knowledge is very limited, and his mind very small, he doubtless frequently sacrifices purity to cheapness in buying, withholding both desiderata from you. Let us hear how your very interesting investigations proceed when you have procured the requisites from a trustworthy establishment.

"J. B. (Dublin)."—If you will send us your name and address, we will make enquiries, and write to you.

"Mr. G. Peel" is requested to send his address for the same purpose.

"J. B. N." will oblige us by giving his name and address, as we wish to communicate with him.

"W. J. C." must excuse the delay. We hope to obtain the address for him in a few days.

"P. N. M." "A Subscriber (Thames Street)," "T. W.," and "Mr. Perry," will hear by post.

"M. P. S. G. B."—We quite agree with you. Wait until next month.

"A Chemist," "Pharmacien," "A Wholesale Druggist," "An Associate," "An Enemy to Humbug," "A Country Chemist," "A Subscriber (Nottingham)," "Beta (Liverpool)," and many other correspondents, who write about the Pharmaceutical Society, will perceive that we have taken up the subject in our present No. If our efforts are backed by exertions on the part of chemists themselves, we have no doubt of success.

We have received the communications of "Alpha," and Mr. J. C. S. Archer.

The letter to Alpha has been forwarded.

Notice.—*All Communications and Books for Review must be addressed* "To the Publisher of The Chemist, 17, Surrey-street, Strand, London." *Communications must be pre-paid, and sent before the 15th of each month. Books for Review before the 10th.*

THE CHEMIST.

[NEW SERIES.]

I. CHEMISTRY.

ON THE SUPERFICIAL CONDUCTIBILITY OF CRYSTALLISED BODIES FOR THE ELECTRICITY OF TENSION.*

BY M. H. DE SENARMONT.

THE electrical properties of crystallised minerals—remarkable in more than one respect—are presented as so many isolated facts, which certainly would be connected with each other and would acquire a collective value, if we had arrived at a more complete knowledge of them, and at determining, by more accurate methods, what portion of these phenomena is accidental and what properly belongs to the regular constitution.

The influences of the crystalline form manifest themselves, indeed, in several peculiarities. It is thus that we sometimes see electricity developed, by friction, constantly positive on some faces and negative on others, and that the pyro-electric faculty appears habitually in correlation with certain derogations from the general laws of symmetry. This ingenious reconciliation is due to Haüy, which, however, is but a vague sketch, and of whose essential conditions and limits we know very little; and although the beautiful experiments of MM. Becquerel, Riess, and G. Rose have since made known many curious properties of pyro-electricity, they do not appear to have added much to the knowledge of the true crystallographic laws of the phenomena, and it would be difficult to distinguish among the latter the part performed by the molecular forces and arrangement.

The electrical properties of minerals may be moreover a complex effect of several simultaneous causes. Many pyro-electric crystals, for example, are seldom simple; they present, for the most part, a mosaic structure; or at least, a want of molecular homogeneity recognisable with polarised

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* *Annales de Chimie et de Physique*, March, 1850.

This memoir is here given as it was presented to the Academy of Sciences at the sittings of Dec. 17, 1849, and January 14, 1850. Since that time, I have had kindly communicated to me, the translation of a work by M. Wiedemann on the same subject, which was presented to the Physical Society of Berlin, on the 2nd of February, 1849, and inserted in Poggendorffs' Annalen, vol. LXXVI., page 404.

M. Wiedemann studied electricity diffused in the state of static tension around a centre, on the surface of crystals which are bad conductors: he therefore employed a mode of experimenting different from that which I used for demonstrating the phenomena which it presents in the state of motion. His observations, when they are made on the same substances, moreover, generally agree with those detailed in this memoir.

The translation of M. Wiedemann's memoir will appear in the next number of the *Annales de Chimie*.

My first experiments were made two years ago, and immediately followed my experiments on the calorific conductibility of crystals. But, in the first instance I did not operate in rarified air, and the experimental method, which was sufficient for convincing me of the reality of the phenomena, did not appear to me sufficiently demonstrative for publication.

light; the superficial alteration of the faces, their relative extent, their arrangement, are so many causes which appear also capable of modifying sometimes even the nature of the electricity produced by friction, and which may likewise influence the distribution of the electricity developed by heat. Finally, there is every reason to believe, that the electrical conductibility of crystals is not, any more than all the other physical circumstances independent, around each point of the direction considered. It could scarcely be doubted, especially since the remarkable experiments of M. Plucker have thrown some light on the unknown relations between the molecular arrangement and properties which had until then appeared independent of it.

I have therefore sought at once to determine the interior and intermolecular conductibility of crystals for dynamic electricity. But, as most of them intercept every current, or give rise to chemical decompositions which complicate the phenomena, I have met with insurmountable difficulties in these attempts; and I tried, if not to measure, at least to prove the unequal resistances which the electricity of tension may experience in moving in various directions on the surface of the crystals.

The mutual independence of what is called the *electric fluid*, and of the matter itself of electrised bodies is perhaps, indeed, less absolute than one would suppose; and if the pressure of the air manifestly interferes in the phenomena, we should recognise, on the other hand, very powerful adherences, for we see portions of substances removed and transported by the spark when it shines between two conducting bodies, ectropion and a superficial disaggregation mark its course when it creeps over imperfectly conducting surfaces.

MM. Riess and Karsten have studied these impressions of the spark*; they have even experimented on some minerals; but, as they proposed to themselves a special object, they directed the explosion in any way, whilst, if we wish to recognise the tendencies of electricity towards certain determined orientations, it must be applied in such a manner as to be free to choose its own route.

I have endeavored to realise this condition by an experimental method based on that which I had already found to succeed for determining the laws of the calorific conductibility of crystallised media.

After having cut, in a leaf of tin, an exactly circular hole, I pasted it on the plane surface of a bad conductor, which it also completely enveloped. It was then covered all over with a conducting envelope except at the point where the circular orifice of the tin leaf leaves the natural surface naked. Then, precisely in the centre of this opening of the metallic armature, I place, normally on the surface of the bad conductor, an isolated point, likewise metallic, by which the electricity arrives. The latter can pass out only by going towards the circumference and by skipping over a non-conducting space. All things are likewise perfectly similar in all directions; the electricity arrives in the centre of a circle, it is equally attracted on all sides by the conducting circumference; it cannot therefore, have other determining directing causes than the molecular causes, if they exist, and differences of superficial conductibility.

The passage of electricity from one conductor to another, on the surface of a bad conducting body, is perhaps a very complex phenomenon. The action and the properties which this experimental method brings into play, the electrical agent itself on which we operate, are too little known for us to have, *a priori*, reason to hope that a simple phenomenon will thus be isolated; but, even taking it as it presents itself, and without going beyond the immediate results of the experiment, we may seek to recognise in it the influence of the crystalline constitution.

In my first experiments, I caused an instantaneous explosion between the central point and the metallic circumference by the discharge of a small battery. When I advanced the leaf of tin and the point in communication with the two armatures of the Leyden Jars, the discharge took place as soon as the increasing tension became capable of overcoming the resistances; it was produced, on the contrary, with an excess of tension when the perfectly charged battery entered suddenly into the circuit by means of an excitor. In all cases the spark leaves on the crystals an enduring trace of its passage.

It may thus be demonstrated that on certain crystals, and, among others, on gypsum, the orientation of the fulminating traces is constant, nearly normal to the dry and vitreous cleavage. But on other matters, whose directive force is less, the regular effects disappear in the accidental anomalies. Now I expected to find that these anomalies were so much the more frequent as the electricity itself had more powerful tension.

* *Archives de l' Electricité, tome* II., pp. 591& 647, and III., p. 310.

In seeking then to diminish the tension I was led to operate in rarified air; and, in reality, the experiment was considerably modified. It appears, indeed, natural to suppose that the resistance of the air, equal in all directions, should interfere only by altering the inequalities proper to the superficial resistances of the crystals; it must, however, be acknowledged that there is in many cases an advantage in preserving in this air a certain tension which appears to augment the stability of the phenomenon.

The continuous and silent influx of electricity into rarified air does not leave, it is true, permanent traces; but it is manifested in the dark by a light which lasts throughout the entire duration of the efflux, and renders visible all its peculiarities.

The operation is made under the receiver of the pneumatic machine. A brass stem, terminating in a drawn out cone, reposes vertically, on its point, on the centre of the circular opening cut in the tin armature which covers the crystals; this stem is isolated and maintained by a support of gum lac, and receives at will the positive or negative electricity from the conductors of a Nairne's machine. As to the conducting armature of the crystal, it is in communication with the ground, and is composed of a thin leaf of tin, pierced with a cutting punch, with exactly circular holes, with perfectly clear edges. This leaf of tin is carefully applied on the faces submitted to experiment, by means of a clear solution of gelatine or of varnish; moreover, it envelopes the crystal at all parts.

The uncovered portion of the crystal is washed with water and with alcohol, then carefully dried; moreover, the trial is repeated with the same face, by turning it in its plane, by displacing and replacing the central point and on different crystals with circles cut of different diameters.

Without pretending to define here what unknown influences may impress on the electric current a determinate orientation, we must regard this orientation, if it exists, as an effect of the crystalline constitution and as the direction of what we call a *maximum superficial conductibility*. We might even add with certainty, that *the minimum direction of conductibility is found at 90 degrees from the first*. Now the results of the experiment may be summed up as follows:—

On homogeneous matters or on crystals of the regular system, electricity developes itself circularly around the central point, and covers the surface of the circle with an uniform light. The same thing appears to take place as regards the crystals of the prismatic system with a square and rhombohedral base, but only when the face is normal to the axis of symmetry.

In all the other cases the phenomenon is different, and when it is shown in all its perfection the light is seen to escape lineally from the centre, in two opposite directions and thus to form a luminous diameter which orients in a fixed azimuth, or radiates a little and balances itself by some slight oscillations to the right and to the left of its true direction; the orientation is very often rendered more stable by leaving to the air a certain tension. This diameter seems to be traversed in two contrary directions by a rapid flux of electricity from the centre, and when the flow of electricity is abundant, it no longer emanates only from the extreme point to glide over the surface of the crystal as a luminous covering without thickness, it leaves the metallic stem at a small height, and the rectilinear luminous currents have an appreciable depth; they orient again under the influence of the crystal when the metallic point does not rest immediately on its surface, but remains suspended, and is separated from it by a small space, a millimetre for example. The sphere of activity of the directive forces appears then to be extended to a certain distance above the surface of the crystals.

When sufficient air remains in the receiver of the pneumatic machine, brilliant and instantaneous sparks are mixed with the permanent violet light; and, if the surface has been sprinkled with sulphur, they leave on this dust the trace of the rectilinear course they have pursued.

There is always observed in these phenomena a decided difference between the two electricities. A very clear experiment when the central receives the positive fluid, becomes completely indeterminate when negative fluid is brought to this point. The latter has even acted hitherto, in all cases, and on crystals of every nature, nearly like the positive fluid on homogeneous bodies, or on crystals of the regular system.

All substances are not, even with positive electricity, equally proper for the manifestation of these phenomena; on certain crystals they trace clearly; on others they are not so well defined, or are perfectly undistinguishable. These differences must depend on the very various energy of the directive force proper to each kind of matter. They are owing also to the deficient precision of the experimental method, which is not of sufficient delicacy for appreciating slight inequalities. However, even in the very rare cases in which the

effects of the directive force are disguised by accidental perturbation, crystals which are not regular are ordinarily presented different from homogeneous substances. The flow of electricity appears more wandering in them, and, instead of covering the circle with an uniform film of cloudy light, it is frequently sputtered into a multitude of divergent threads which skip suddenly from one part of the circumference to another.

Independently of the causes of error inherent to the imperfections of the experimental method, there are others, whose influence can only be presumed. Even surfaces which have retained their natural polish, or which result from a clear cleavage, will impress on the electricity a regular orientation. But it is conceived that it may be disturbed if the surface is rough, striated, scratched and unpolished, or even artificially polished. On thus designedly altering natural faces, of which we had previously been able to study the proper effects, they were sometimes found to be modified, especially when the crystals have not a great directive energy; sometimes they do not appear changed, without its being always possible to perceive the reason of these differences. As to striæ and natural asperities, they do not seem to have any appreciable influence unless they are extremely distinct.

I have, therefore, as much as possible, in order to be sure of the results, sought to operate on natural faces or those obtained by cleavage. It is necessary that they should be sufficiently broad, that they be not too much deformed, and as the very good conducting crystals are excluded by the very principle of the experimental method, we feel how much these difficult conditions limit the number of matters applicable to these trials, and it will be understood that I have not experimented on more than thirty-six different substances.

Be it as it may, every time that the results of the experiment were clear and decisive, they showed an intimate and very simple correlation between the axes of symmetry and the directions of maximum or minimum conductibility as previously defined. These results, it must be acknowledged, would not perhaps be sufficiently numerous to enable us to disentangle *a priori* the crystallographic laws from the electrical phenomena, if this physical property of the crystals had been first discovered, and to justify a collection of systematic consequences, if they were isolated. But we already know the part which the remarkable results of regular aggregation designated under the name of *axes of symmetry* perform in experiments of another kind. Their influence is manifested in an analogous manner in various phenomena which will thus to a certain extent be explained one by another: each fact observed finds by comparison in a different order of physical properties, a corresponding fact which serves as an explanation of it; and if, after incomplete experiments, there still remains something obscure or insufficiently demonstrated in the laws of superficial electrical conductibility, the laws of luminous or calorific propagation will aid in its elucidation.

We will not then allow ourselves to be stopped by a few doubtful proofs, such as must necessarily be presented by an experimental method without precision. In order to regard the induction as legitimate, and in order to think ourselves warranted in now generalising the results of the experiment, it will be sufficient that clear and precise facts all come in support of our conclusions; they will not be shaken by undecisive proofs, provided they are never contradictory.

I employed in the following experiments cut circles, which will be designated by the Nos. 1, 2, 3, 4, 5, 6, and which are respectively 10, 15, 20, 25, 30, and 35 millimetres in diameter: the results which I give here are, moreover, those manifested by positive electricity, when it arrives by the central point.

HOMOGENEOUS BODIES.

On planes of crown and flint glass, of sulphur, of gum lac, and of resin, obtained by running these matters when fused on a polished surface, the surface of the circles was always covered with an uniform light; on gutta percha, notwithstanding the fibrous texture which it acquired by rolling, the same phenomenon was remarked.

In order to appreciate the influence of striæ and asperities, I cast with sulphur and gum lac the surfaces of certain crystals naturally rough or striated; I took impressions of magnetic oxide of iron, quartz, beryl, epidote, felspar, and tourmaline, and I never remarked any very sensible influence so long as the inequalities were not too great.

When the striæ became actual, parallel, deep, and close channels, as I have obtained by running sulphur on certain selected crystals of dodecahedral magnetic oxide of iron, the electricity appeared to follow in preference the furrows.

If a portion of the surface be scratched and its polish removed with scouring paper or a file, whilst the remainder retains its

original polish, the superficial disaggregation sometimes produces differences: the portion whose polish has been removed usually acquires a greater conductibility.

CRYSTALS OF THE REGULAR SYSTEM.

1. *Fluor Spath*, natural faces of the cube and octohedral cleavages.

2. *Rock Salt*, natural faces of the cube and cubic cleavages.

3. *Alum*, natural faces of the octohedron.

4. *Blende*, dodecahedral cleavages acted like homogeneous bodies.

5. Magnetic oxide of iron, pyrites, and galena were ill adapted for the experiments because these substances are too good conductors, and we are seldom and only accidentally able to force the electricity to travel by the surface, becoming luminous.

CRYSTALS OF THE RIGHT PRISMATIC SYSTEM WITH A SQUARE BASE.

Idocrase.—1. Face very level, natural base of a large cylindrical crystal from Piedmont, edged with some exceedingly narrow facettes. Circle No. 2. Light uniform.

2. Natural lateral face of a crystal from the lake of Baïkal, feebly and irregularly striated and riddled with small grains foreign to the crystallisation; face polished artificially with the same defects. Circle No. 2. Maximum conductibility parallel to the axis and, consequently, to the striæ Experiments doubtful, on account of the smallness of the circle, and the state of the surfaces.

Oxide of tin. Natural lateral face, rather channelled. Circles Nos. 1 and 2. Maximum conductibility normal to the axis and to the striæ. Experiments very doubtful, on account of the conductibility which renders the production of light difficult to obtain, of the smallness of the circle and of the state of the surface. On two other larger natural faces and on artificially polished faces, it was impossible to force the electricity to a regular superficial passage accompanied by light.

Rutile.—Artificially polished surfaces very nearly parallel to the axis. Circles Nos. 2 and 3. Maximum conductibility normal to the axis of symmetry.

To be continued.

ON THE SEPARATION OF SOME ACIDS OF THE SERIES $C^nH^nO^4$.*

BY PROFESSOR LIEBIG.

WHEN we have a mixture of butyric and valerianic acid, and when it is required to separate one or other of these acids even in small quantity, the following process may be employed: a portion of the mixture of the acids is saturated with potassa or soda, the remainder is added, and the whole distilled.

Two cases are here presented.

When the mixture contains more valerianic acid than is sufficient for saturating all the alkali, the residue will contain no butyric acid, but only pure valerianic acid.

When the quantity of valerianic acid contained in the mixture is insufficient for saturating the alkali, the residue contains besides the whole of the valerianic acid, a certain quantity of butyric acid; but the product of the distillation consists of pure butyric acid.

The quantity of alkali to be added to a mixture must, consequently, be calculated according to the quantity of valerianic acid it is supposed to contain. If the mixture contains 10 per cent., one-tenth of the acid must be saturated. When it is required to separate from an impure valerianic acid 10 per cent. of butyric acid, nine-tenths of the mixture must be saturated.

From the foregoing it is easy to perceive that a single operation is sufficient for obtaining one of the acids in the state of purity. Either the product of the distillation is pure butyric acid, and then the residue contains a mixture of valerianic and butyric acids; or the product of the distillation contains a mixture of butyric and valerianic acids, and then the residue contains pure valerianic acid.

By repeating the same operations on the residue or on the product of the distillation, an additional portion of one of the acids is obtained in the state of perfect purity, and, by continuing these saturations and fractioned distillations, a complete separation of the acids may finally be effected.

As butyric and valerianic acids differ in their boiling point, it may be supposed that soda, in combining with the least volatile acid prevents it from volatilising at the temperature at which the other boils. Indeed, when in a mixture of valerianic and butyric acids the first is rendered fixed, it is evident that the second may be distilled over perfectly pure.

A mixture of valerianic acid and acetic acid, or of butyric acid and acetic acid, acted in a completely different manner. When such a mixture is partially saturated with potassa, and submitted to distillation, the acetic acid does not come over as might be expected, but the other two acids, although the boiling point of acetic acid is more than 120° F. lower than that of bu-

* *Annalen der Chemie und Pharmacie.*

tyric acid, and fully 160° F. below that of valerianic acid.

The reason of this is, that an acid acetate is formed which is not decomposed by the two less volatile acids.

Indeed, if we add valerianic acid to a dilute solution of neutral acetate of potassa, this acid is dissolved in considerable quantity; whilst it remains in the form of oily drops in a solution of acid acetate of potassa, in which it does not appear to be more soluble than in water.

When we submit to distillation a solution of neutral acetate of potassa to which an excess of valerianic acid has been added, a portion of this acid passes over, and there remains in the residue a mixture of acid acetate of potassa and valerianate of potassa.

When a mixture of acid acetate of potassa and valerianic acid is distilled, this acid passes over and the acid acetate of potassa remains as a residue, free from valerianic acid.

Butyric acid acts with acetate of potassa like valerianic acid.

From the foregoing it results that when we saturate with potassa butyric or valerianic acid containing acetic acid, and submit the whole to distillation, one of two things occurs: either the acetic acid remains entirely in the residue with a certain quantity of butyric acid, and then the acid which distils over is free from acetic acid; or the residue is formed solely of acetic acid, and then the product of the distillation also contains acetic acid which may be separated from butyric or valerianic acid by a second similar treatment.

OBSERVATIONS ON ETHERIFICTION.

BY THOMAS GRAHAM, ESQ., F.R.S., F.C.S., PROFESSOR OF CHEMISTRY IN UNIVERSITY COLLEGE, LONDON.*

IN the ordinary process of etherising alcohol by distilling that liquid with sulphuric acid, two distinct chemical changes are usually recognised; namely, first, the formation of sulphovinic acid, the double sulphate of ether and water; and, secondly, the decomposition of the compound named, and liberation of ether. The last step, or actual separation of the ether, is referred to its evaporation in the circumstances of the experiment, into an atmosphere of steam and alcohol vapor, assisted by the substitution of water as a base to the sulphuric acid, in the place of ether. The observation, however, of Professor Liebig, that ether is not brought off by a current of air passing through the heated mixture of sulphuric acid and alcohol, is subversive of the last explanation, as it demonstrates that the physical agency of evaporation is insufficient to separate ether. Being induced to try whether ether could not be formed without distillation, I obtained results which appear to modify considerably the views which can be taken of the nature of the etherising process:

The spirits of wine or alcohol employed in the following experiments, was always of the density of ·841, or containing 83 per cent. of absolute alcohol.

EXPERIMENT I.—One volume of sulphuric acid was gradually added to four volumes of alcohol, so as to prevent any considerable rise in the temperature. The mixture was sealed up in a glass tube, 1 inch in diameter and 6·6 inches in length, of which the liquid occupied 5·2 inches, a space of 1·4 inch being left vacant, to provide for the expansion of the liquid by heat. The tube was placed in a stout digester containing water, and was safely exposed to a temperature ranging from 284 to 352° F. for one hour.

No charring occurred, but the liquid measured on cooling, 5·25 inches in the tube, and divided into two strata. the upper occupying 1·75 inch, and the lower 3·5 inches of the tube. The former was perfectly transparent and colorless, and, on opening the tube was found to be ether, so entirely free from sulphurous acid that it did not affect the yellow color of a drop of a solution of bichromate of potassa. The lower fluid had a slight yellow tint, but was transparent. It contained some ether, but was principally a mixture of alcohol, water and sulphuric acid. The salt formed by neutralising this acid fluid with carbonate of soda did not turn black when heated, from which we may infer that little or no sulphovinic acid was present.

The principal points to be observed in this experiment are its entire success as an etherising process, without distillation, without sensible formation of sulphovinic acid, and with a large proportion of alcohol in contact with the acid, namely, nearly two equivalents of the former to one of the latter. When the proportion of the alcohol was diminished, the results were not so favorable.

EXPERIMENT II.—A mixture of one volume of sulphuric acid and two volumes of alcohol, sealed up in a glass tube, was

* *Journal of the Chemical Society*, April, 1850.

heated in the same manner as the last. The liquid afterwards appeared of an earthy brown color by reflected light, and transparent and red by transmitted light. Only a film of ether was perceptible after 24 hours, floating on the surface of the dark fluid.

EXPERIMENT III.—With a still smaller proportion of alcohol, namely, one volume of sulphuric acid with one volume of alcohol, which approaches the proportions of the ordinary etherising process, a black, opaque liquid was formed at the high temperature, thick and gummy, without a perceptible stratum of ether, after standing in a cool state.

Crystals of bisulphate of soda, containing a slight excess of acid, were found to etherise about twice their volume of alcohol, in a sealed tube, quite as effectually as the first proportion of sulphuric acid, when heated to the same temperature. The two liquids found in the tube were colorless, no sulphurous acid appeared, and only a minute quantity of sulphovinic acid. Crystals of bisulphate of soda, which were formed in an aqueous solution, and without an excess of acid, had still a sensible but much inferior etherising power.

EXPERIMENT IV.—A mixture was made of sulphuric acid with a still larger proportion of alcohol, namely, one volume of the former and eight of the latter, or nearly one equivalent of acid to four equivalents of alcohol. This mixture was sealed up in a tube and heated for an hour between 284 and 317° F., which appeared sufficient for etherising it. A second exposure for another hour did not perceptibly increase the produce of ether. The stratum of ether measured 1·25 in the tube, and the acid fluid below 2·5 inches. Both fluids were perfectly colorless.

It thus appears that it is unnecessary to exceed the temperature of 317° F. in this mode of etherising, and that the proportion of alcohol may be increased to eight times the volume of the sulphuric acid without disadvantage.

EXPERIMENT V.—The proportions of the first experiment were again used, namely, one volume of sulphuric acid with four volumes of alcohol, and the mixture heated as in the last experiment to 317° F. The upper fluid, or ether, measured 1·1 inch in the tube, and the lower fluid 2·65 inches. The latter had a slight yellow tint, like nitrous ether, but only just perceptible. When neutralised by chalk, it gave:—

Sulphate of lime.....83·11 grains.
Sulphovinate of lime.... 4·91 „

The last salt was soluble in alcohol, and crystallised in thin plates.

Here again the formation of sulphovinic acid in a successful etherising process is quite insignificant.

New results at 317° F., from the other proportions of one volume of sulphuric acid with one and two volumes of alcohol, were quite similar to those obtained in experiments 2 and 3, at the higher temperature of 352° F. In none of these experiments did there appear to be any formation of olefiant gas, and the tubes could always be opened, when cold, without danger.

Neither glacial phosphoric acid nor crystallised biphosphate of soda etherised alcohol in the slightest degree, when heated with it in a sealed tube to 360° F. Even chloride of zinc produced no more, at the same temperature, than a trace of ether, perceptible to the sense of smell.

EXPERIMENT VI.—In order to illustrate the ordinary process of ether making, a mixture was prepared, as usually directed, of:—

Sulphuric acid..... 100 parts
Alcohol ·841..... 48 „
Water..... 18·5 „

This liquid was sealed up in a glass tube, and heated to 290° for one hour. It became of a dark greenish-brown color, and opalescent, with a gummy looking matter in small quantity. No stratum of ether formed on the surface of the fluid.

The tube was opened and the fluid divided into two equal portions. One of the portions was mixed with half its volume of water, and the other with half its volume of alcohol, and both sealed up in glass tubes, and again exposed to 290° F. for an hour.

It would be expected, according to the ordinary view of water setting free ether from sulphovinic acid, that much ether would be liberated in the mixture above, to which water was added. The ether which separated, however, amounted only to a thin film, after the liquid had stood for several days. In the other liquid, on the contrary, to which alcohol was added, the formation of ether was considerable, a stratum of that liquid appearing, which exceeded half the original volume of the alcohol added. In fact the sulphovinic acid was nearly incapable of itself of yielding ether, even when treated with water. But it was capable of etherising alcohol added to it, in the second mixture, like bisulphate of soda or any other acid salt of sulphuric acid.

The conclusions which I would venture to draw from these experiments are the following.

The most direct and normal process for

preparing ether appears to be, to expose a mixture of sulphuric acid with from four to eight times its volume of alcohol of 83 per cent., to a temperature of 320° F., for a short time, Owing to the volatility of the alcohol, this must be done under pressure, as in the sealed glass tube. The sulphuric acid then appears to exert an action on the alcohol, to be compared with that which the same acid exhibits when mixed in a small proportion with the essential oils. Oil of turpentine, mixed with one-twentieth of its volume of sulphuric acid, undergoes an entire change, being chiefly converted into a mixture of two other hydrocarbons, terebene and colophene, one of which has a much higher boiling point and greater vapor-density than the oils of turpentine. This hydrocarbon does not combine with the acid, but is merely increased in atomic weight and gaseous density without any further derangement of composition, by a remarkable polymerizing action, (as it may be termed) of the sulphuric acid. So of the hydrocarbon of alcohol; its density is doubled in ether, by the same polymerizing action. Chloride of zinc effects, with alcohol, at an elevated temperature, a polymeric catalysis of the latter, of the same character, but in which hydrocarbons are formed, of even greater density and free from oxygen.

This view of etherification is only to be considered as an expression of the contact-theory of that process which Mitscherlich has long so ably advocated.

The formation of sulphovinic acid appears not to be a necessary step in the production of ether; for we have found that the etherising proceeded most advantageously with bisulphate of soda, or with sulphuric acid mixed with a large proportion of alcohol and water, which would greatly impede the production of sulphovinic acid. It appears, indeed, that the combination of alcohol with sulphuric acid, in the form of sulphovinic acid greatly diminishes the chance of the former being afterwards etherised; for, when the proportion of sulphuric acid was increased in the preceding experiments, which would give much sulphovinic acid, the formation of ether rapidly diminished. The previous conversion of alcohol into sulphovinic acid appears, therefore, to be actually prejudicial, and to stand in the way of its subsequent transformation into ether.

The operation of etherising has attained a kind of technical perfection in the beautiful continuous process now followed. The first mixture of alcohol and sulphuric acid is converted into sulphovinic acid, the sulphate of ether and water, which acid salt appears to be the agent which polymerizes all the alcohol afterwards introduced into the fluid. Bisulphate of soda, with a slight excess of acid, acts upon alcohol in the same manner, and its substitution for the acid sulphate of ether would have a certain interest, in a theoretical point of view, although a change of no practical importance in the preparation of ether.

Sulphuric acid does not appear to be adapted for the etherising of amylic alcohol. M. Balard, by distilling these substances together, obtained a variety of hydrocarbons, some of them of great density, but no ether. The polymerizing action of the sulphuric acid appears to advance beyond the ether stage. I have varied the experiment by heating amylic alcohol, in a close tube, to 350° F., with sulphuric acid, to which 1, 2, 3, 4, and even 6 equivalents of water had been added without obtaining anything but the hydrocarbons of Balard. The formation of these was abundant, even with the most highly hydrated acid, and with a very moderate coloration of the fluid.

ON THE SEPARATION OF PHOSPHORIC ACID FROM ALL BASES, AND ESPECIALLY FROM ALUMINA.*

BY PROFESSOR ROSE.

Some time ago, Professor H. Rose published a process which enables us to separate phosphoric acid from various bases with more accuracy than by the methods previously employed. This process consists in treating the insoluble phosphates with nitric acid and mercury, and in evaporating to dryness so as to drive off all the excess of nitric acid. When the residue is treated with water, the phosphoric acid remains in the state of phosphate of protoxide of mercury, and the bases are dissolved. However, feeble bases, such as oxide of iron and alumina, do not separate from the phosphoric acid in these circumstances. The author has pointed out a process of separating the oxide of iron in the residue of phosphate of protoxide of mercury.

When the matter to be analysed contains alumina, the separation of this base presents such difficulties that it is better to renounce the method founded on the employment of mercury and to adopt the process which Professor Rose now describes.

* *Annalen der Chemie und Physik*; von J. C. Poggendorff.

This process is founded on the following fact. When a phosphate insoluble in water is dissolved in hydrochloric or nitric acid, and the acid liquor saturated by means of carbonate of baryta, all the phosphoric acid is precipitated in the state of phosphate of baryta. The bases which the liquor contained, are divided into two parts: the feeble bases, as oxide of iron and alumina, are precipitated with the phosphate of baryta; the powerful bases remain in solution. The problem is, therefore, reduced in the last place, to separating the phosphoric acid from the baryta, alumina and oxide of iron.

For that purpose, Professor Rose begins by dissolving the precipitate in hydrochloric acid, and precipitates the baryta by sulphuric acid. The acid liquor is filtered and saturated by means of carbonate of soda, and evaporated to dryness. The dry residue is carefully mixed in an agate mortar with its weight of very pure silica and six times its weight of carbonate of soda. This mixture was calcined at a powerful red heat in a platinum crucible.

The phosphoric acid combined entirely with the soda. It was separated from the insoluble bases by digesting the calcined mass with pure water until the part which does not dissolve had the appearance of a fine powder. It is filtered and carbonate of ammonia is added, which precipitates all the silica contained in the liquor.

When the silica is deposited it is filtered again, and supersaturated by an acid which should form no precipitate of silica, and the phosphoric acid is precipitated in the state of ammoniaco-magnesian phosphate. This process, already partly pointed out by Berzelius and Fuchs; is long and tedious, but it gives sufficiently accurate results.

Professor H. Rose recommends the employment of his new method only in cases in which it is certain that alumina exists in the insoluble phosphates to be analysed.

ON THE COMPOSITION OF THE PRECIPITATE FORMED BY SUBACETATE OF LEAD IN THE SOLUBLE CYANIDES.*

BY E. ERLENMEYER.

WHEN prussic acid is added to subacetate of lead, no precipitate is formed. It is only by the addition of a certain quantity of ammonia that a white pulverulent precipitate is obtained, which is readily deposited.

To analyse it, Mr. Erlenmeyer washed it with water free from carbonic acid, collected it on a filter and dried it on watch glasses under a bell-glass containing quick-lime and sulphuric acid. During the desiccation, the precipitate, whose color gradually passes to yellowish white, continually disengages prussic acid. When dry, the decomposition stops. According to the author, this precipitate contains in the dry state

2 PbO, PbCy.

Its composition is the same, whether aqueous or alcoholic solutions of ammonia or of potassa be employed for its preparation.

The author adds that it appears probable that the white precipitate is at first cyanide of lead, which is gradually decomposed by the water into prussic acid and oxide of lead; the decomposition would stop when the composition of the substance is that indicated by the foregoing formula.

* *Journal für Praktische Chemie.*

CHEMICAL RESEARCHES ON A ROOT WHICH GROWS IN THE ORIENTAL REPUBLIC OF URUGUAY, (MONTEVIDEO), CALLED BY THE INDIANS GUAICURU.*

BY M. LENOBLE.

THIS root is very analogous to bistort; it possesses externally a blackish color, and internally a reddish color; its taste is astringent.

The inhabitants of the Republic have much confidence in the properties of this root, which they employ in the treatment of syphilis, for arresting hæmmorrhage and for curing piles.

I followed the method of displacement for extracting the active principle of this root.

Hydrated sulphuric ether was colored of a greenish yellow, possessing an astringent taste, and reddening litmus paper: evaporated to dryness, I obtained a residue of a chesnut color, almost entirely soluble in water; this solution was precipitated in white flocks by a solution of gelatine; it was likewise precipitated of a bluish black by a soluton of a salt of iron. The insoluble portion was of a resinous nature.

Distilled water dissolved out a reddish coloring principle, having an astringent taste and reddening litmus paper; the solutions of gelatine and of sulphate of iron produced in this liquid respectively a flocculent white and a bluish black precipitate; hydrate of lime, mixed with this liquid, produced, by means of heat, a disengagement of ammoniacal gas; reddened litmus paper,

* *Journal de Pharmacie*, March, 1850.

held in the mouth of the vessel, was restored to blue.

A small quantity of powder of guaïcuru, contained in a tube, and subjected to a high temperature, produced a disengagement of ammoniacal gas; a piece of reddened and previously moistened litmus paper having been held in the mouth of the tube, was immediately restored to blue.

The following are the proximate principles found in the root of guaïcuru:—

1. Tannic acid: *
2. Resin held in solution by means of tannic acid:
3. Reddish coloring principle, soluble in water and in alcohol:
4. A salt of ammonia.

CHEMICAL INVESTIGATIONS CONCERNING A CONCRETION FOUND IN THE STOMACH OF A MILK COW (AT MONTEVIDEO). †

BY M. LENOBLE.

THIS kind of concretion is met with in the stomach only of domestic milk cows; wild cows, which are very common in this country, are generally free from them.

The crust of this substance is shining, of a blackish color, it is internally formed of hair; it possesses an odor *sui generis*.

I will here point out the means which I employed for ascertaining the chemical composition of the external portion of this substance.

After having pulverised it, I divided the product into three parts. The first part was treated with distilled water sharpened with nitric acid; there was a disengagement of carbonic acid; *oxalate of ammonia* produced in this solution a pearly white precipitate *(oxalate of lime.)*

The second portion was submitted to the action of distilled water carried to the temperature of 120° F. This liquid was colored yellow; it was without action on blue litmus paper and also on the same paper previously reddened by an acid.

The third and last portion was treated with boiling alcohol, which acquired a yellow color; on cooling it deposited a yellowish substance; a few drops of concentrated sulphuric acid poured on the latter produced a change of color, that is to say, it turned green.

There existed also in the same precipitate a small quantity of fusible and inflammable matter, giving out in burning, an odor similar to that which is produced by the decomposition of stearine.

I conclude, from these various reactions, that the external crust of this concretion is composed of:—

1. Carbonate of lime:
2. Yellow coloring matter (concrete bile):
3. Animal mucus:
4. Fatty matter, analogous to cholesterine.

USES.—Calcined, and then diffused in water, the country people administer it in certain diseases. Like camphor it prevents insects from biting clothing.

* The root contains one-tenth per cent. of tannic acid.

† *Journal de Pharmacie*, March, 1850.

ON A SERIES OF INSOLUBLE ALKALINE PHOSPHATES AND ARSENIATES.*

BY PROFESSOR H. ROSE.

WHEN an organic substance is carbonised in a close vessel, and when the resulting charcoal is exhausted by water until that liquid dissolves no more, hydrochloric acid extracts from the carbonised mass often considerable quantities of potassa and soda, as well as earthy phosphates.

In most cases these alkalies are combined with ordinary phosphoric acid, forming with the earthy phosphates double salts insoluble in water.

The author demonstrates that there exists a class of double phosphates analogous to the ammoniaco-magnesian phosphate, into the composition of which there may enter potassa, soda, or lithia, in place of ammonia, and lime in place of magnesia.

These double salts are formed when the phosphates of lime and magnesia are fused with an alkaline carbonate. Only it is difficult to prepare them in the state of purity; for when an excess of carbonate is employed, it happens that a portion of the double earthy and alkaline phosphate is decomposed by the excess of alkaline carbonate; if, on the contrary, an excess of earthy phosphate be used, the latter remains mixed with the double phosphate.

To prepare these double phosphates, it is necessary to mix exactly one equivalent of pyrophosphate of lime or magnesia with one equivalent of carbonate of soda, and to calcine the mixture until all the carbonic acid is expelled. The calcined mass is exhausted with boiling water.

It is advisable not to allow these washings

* *Poggendorff's Annalen der Chemie und Physik.*

to continue too long; for it sometimes happens that water decomposes these double phosphates, carrying away from them a more or less considerable quantity of alkali, and substituting itself in the combination for the molecule of fixed alkali.

In the pure state, the double earthy and alkaline phosphates present a crystalline texture.

Professor Rose has demonstrated the existence of the following compounds, prepared and analysed by M. Weber :—

Double phosphate of potassa and lime	$PhO^5 \left\{ \begin{matrix} 2CaO \\ PO \end{matrix} \right.$
,, ,, ,, soda and lime	$PhO^5 \left\{ \begin{matrix} 2CaO \\ SoO \end{matrix} \right.$
,, ,, ,, potassa and strontia	$PhO^5 \left\{ \begin{matrix} 2SrO \\ PO \end{matrix} \right.$
,, ,, ,, soda and strontia	$PhO^5 \left\{ \begin{matrix} 2SrO \\ SoO \end{matrix} \right.$
,, ,, ,, potassa and baryta	$PhO^5 \left\{ \begin{matrix} 2BaO \\ PO \end{matrix} \right.$
,, ,, ,, soda and baryta	$PhO^5 \left\{ \begin{matrix} 2BaO \\ SoO \end{matrix} \right.$
,, ,, ,, potassa and magnesia	$PhO^5 \left\{ \begin{matrix} 2MgO \\ PO \end{matrix} \right.$
,, ,, ,, soda and magnesia	$PhO^5 \left\{ \begin{matrix} 2MgO \\ SoO \end{matrix} \right.$
,, ,, ,, lithia and lime	$PhO^5 \left\{ \begin{matrix} 2CaO \\ LiO \end{matrix} \right.$

There exists a class of arseniates analogous to the phosphates of which we have just given the composition. The author has prepared two of them, the double arseniate of potassa and magnesia

$$AsO^5 \left\{ \begin{matrix} 2MgO \\ PO \end{matrix} \right.$$

And the double arseniate of soda and magnesia

$$AsO^5 \left\{ \begin{matrix} 2MgO \\ SoO \end{matrix} \right.$$

The salts were prepared by means of the ammoniaco-magnesian arseniate, which is so easily obtained. After having heated it until it had lost the ammonia and water that it contained, it was calcined with carbonate of potassa or soda, and the calcined mass was treated with water. During these washings a portion of the double arseniate was decomposed, a certain quantity of water taking the place of one equivalent of potassa or soda. Thus the analyses of Professor Rose do not entirely agree with the formulæ which we have just given.

NEW EXPERIMENT ON COMPLEMENTARY COLORS.*

BY M. MAUMENÉ.

It is known that two complementary colors combined produce white, and it is generally shown in lectures by making use of two glasses, one red and the other green, whose tints, although very deep, entirely disappear during the simultaneous interposition of the two plates between the eye and the light. I have for some years attained the same result by using colored liquors, and especially by mixing a solution of cobalt and a solution of nickel, both very pure, and diluted with water until they both have nearly the same intensity of color. The rose red of the cobalt is completely extinguished by the green of the nickel, even in very concentrated solutions, and the mixed liquor is colorless.—Sometimes a very slight brownish yellow tint remains; but this tint leaves no doubt concerning the recomposition of white light.

The two metals are often mixed in laboratory products; we are frequently surprised at obtaining abundant precipitates from almost colorless liquids; but the foregoing explains this singularity. All chemists who have had anything to do with nickel and cobalt will doubtless call to mind these facts, which are so easily verified.

* *Comptes Rendus*, No. 8, Feb. 25, 1850.

ON A NATIVE BORATE.*

BY G. L. ULEX.

Below the nitre beds of southern Peru, there are found white, tubercular masses, called in that country, *Tiza*. Their size varies from that of a hazel nut to that of a moderate sized potato, and their external appearance is precisely that of the Aluminite described by Halle; but the broken surfaces

* *Annalen der Chemie und Pharmacie.*

show that the mass is composed of soft, white, silky, interlacing fibres; they rapidly absorb water, and have a somewhat saline taste. Imbedded in the tubercular masses, there are sometimes found sharp edged fragments of *Andesite*, and of quartzose and argillaceous minerals, and, invariably, large rhombic prisms of Brongniartin. The density of the crystaline fibres is 1·8; their form appears to be that of a hexagonal prism, or perhaps a rhombic prism with the acute lateral edges truncated. The following is their composition:—

Boracic acid	49·5	49·5
Lime	15·7	15·9
Soda	8·8	8·8
Water	26·0	25·8
	100·0	100·0

Under the assumption that the relation of the boracic acid to the soda is the same as in borax, these numbers give the formula:—

$$SoO\ 2BO^3 + 2CaO\ 3\ BO^3 + 10Aq.$$

Mr. Ulex regards this mineral as identical with Hayes' *hydro-borocalcite*.

The Brongniartin with which this borate is mixed, consists of sulphates of soda and lime

$$SoO\ SO^3 + CaOSO^3.$$

OBSERVATIONS ON THE ADJUSTMENT OF THE RELATIONS BETWEEN THE ANIMAL AND VEGETABLE KINGDOMS, BY WHICH THE VITAL FUNCTIONS OF BOTH ARE PERMANENTLY MAINTAINED.*

BY ROBERT WARINGTON, ESQ., F.C.S.

THIS communication consists of a detail of an experimental investigation which has been carried on for nearly twelve months, and which appears to illustrate, in a marked degree, that beautiful and wonderful provision which we see displayed throughout the animal and vegetable kingdoms, whereby their continued existence and stability are so admirably sustained, and by which they are made mutually to subserve, each for the others' nutriment, and even for its indispensable wants and vital existence. The experiment has reference to the healthy life of fish preserved in a limited and confined portion of water It was commenced in May, 1849, and the subjects chosen were two small gold fish. These were placed in a large glass receiver, of about 12 gallons capacity, having a cover of thin muslin stretched over a stout copper wire, bent into a circle, placed over its mouth, so as to exclude, as much as possible, the sooty dust of the London atmosphere, without, at the same time, impeding the free passage of the atmospheric air. This receiver was about half filled with ordinary spring water, and supplied at the bottom with sand and mud, together with loose stones of larger size, of limestone tufa, from the neighborhood of Matlock, and sandstone; these were arranged so that the fish could get below them, if they wished so to do. At the same time that the fish were placed in this miniature pond, a small plant of the *Vallisneria spiralis* was introduced, its roots being inserted in the mud and sand, and covered by one of the loose stones, so as to retain the plant in its position. The *Vallisneria* is one of those delicate aquatic plants generally selected by the microscopist for the exhibition of the circulation of the sap in plants. It throws out an abundance of long, wiry, strap like leaves, of about a quarter of an inch in breadth, and from one to three feet in length; these leaves, when the sun shines on them, evolve a continued stream of oxygen gas, which rises in a current of minute bubbles, particularly from any part of the leaf which may have received an injury.

The materials being thus arranged, all appeared to go on well for a short time, until circumstances occurred which indicated that another and a very material agent was required to perfect the adjustment, and which, from my not having thought of it at the time of commencing the experiment, had not been provided against. The circumstances I allude to arose from the internal decay of the leaves of the *Vallisneria*, which became yellow from having lost their vitality, and began to decompose; this, by accumulation, rendered the water turbid, and caused a growth of mucus, or green, slimy matter, on the surface of the water, and on the sides of the receiver. If this had been allowed to increase, I conceive that the healthy life of the fish must have suffered, and probably their vital functions have been destroyed. The removal of these decaying leaves from the water, therefore, became a point of paramount importance to the success of the experiment. To effect this, I had recourse to a very useful little scavenger, whose beneficial functions have been too much overlooked in the economy of animal life;—I mean the water snail, whose natural food is the very green, slimy growth, or mucus and decaying vegetable matter, which threatened to destroy the

* *Journal of the Chemical Society*, April, 1850.

object I had in view. Five or six of these creatures—the *Himnæa stagnalis*,—were consequently introduced, and, by their rapid and continued locomotion and extraordinary voracity, soon removed the cause of interference, and restored the whole to a healthy state, thus perfecting the balance between the animal and vegetable inhabitants, and enabling both to perform their vital functions with health and energy.

So luxuriant was the growth of the *Vallisneria* under these circumstances, that, by the autumn, the one solitary plant, which had been originally introduced, had thrown out myriads of off-shoots and suckers, thus multiplying to the extent of upwards of thirty fine strong plants; and these threw up their long, spiral, flowering stems in all directions, so that, at one time, more than forty blossoms were lying on the surface of the water.

The fish have been lively, bright in color, and appear very healthy, and the snails also,—judging from the enormous quantity of gelatinous masses of eggs which they have deposited on all parts of the receiver, as well as on the fragments of stone—appear to thrive wonderfully, and, besides their functions in sustaining the perfect adjustment of the series, afford large quantities of food to the fish in the form of young snails, which are devoured as soon as they exhibit signs of vitality and locomotion, and before their shell has become hardened.

Thus we have that admirable balance sustained between the animal and the vegetable kingdoms, and that in a liquid element. The fish, in its respiration, consumes the oxygen held in solution by the water as atmospheric air; furnishes carbonic acid; feeds on the insects and young snails; and excretes material well adapted as a rich food for the plant, and well fitted for its luxuriant growth.

The plant, by its respiration, consumes the carbonic acid produced by the fish, appropriating the carbon to the construction of its tissues and fibre, and liberates the oxygen in its gaseous state to sustain the healthy functions of the animal life, at the same time that it feeds on the rejected matter, which has fulfilled its purposes in the nourishment of the fish and snail, and preserves the water constantly in a clear and healthy condition, whilst the slimy snail, finding its proper nutriment in the decomposing vegetable matter and minute confervoid growth, prevents their accumulation by removing them from the field, and, by its vital powers, converts what would otherwise act as poison, into a rich and fruitful nutriment, again to constitute a pabulum for the vegetable growth, whilst it also acts the important part of a purveyor to its finny neighbour.

ON A NEW REAGENT FOR DETECTING THE PRESENCE OF SUGAR IN CERTAIN LIQUIDS.*

BY M. MAUMENÉ.

Chemists have pointed out several processes for the detection of sugar, even in the singular circumstances of diabetes. Unfortunately, none of these processes is sufficiently simple to be easily adopted in medical practice. I now present to chemists and physicians a test paper, or rather a test tissue, by means of which the presence of the most minute quantities of sugar may be detected.

The action of chlorine on sugar is very imperfectly known, and the experiments which I have made with the view of throwing some light on this subject have led me to notice many inaccuracies in the statements made by some celebrated chemists. Thus, Liebig says, chlorine acts, even when dry, on sugar; it requires only 212° F. to determine the reaction; without heat, more time is required. In all cases, there is formed a brown matter partially soluble in water, a caramel of a brilliant black when it is dried. That which is obtained with chlorine, is obtained as easily, at least, with the chlorides and especially with the perchlorides.

All the sugars act with the chlorides in the same manner as cane sugar; all undergo that dishydratation of which the black brown product is the final term. And this is not all: as might be foreseen, the matters whose composition is analagous to that of sugar and which, like sugar, may be represented by charcoal and water, likewise undergo the same kind of alteration: ligneous matter, hemp, flax, cotton, paper, starch, fecula, &c., are in this position.

From all these facts results the knowledge of the conditions in which we must be placed to obtain a paper, or rather, a solid strip covered with a reagent proper for detecting the presence of sugar. Let us take, indeed, a sheet of solid matter, unalterable by chloride of tin, even at a high temperature, and let us cover this matter with a layer of chloride, by means of a concentrated solution and dessication, then let us dip the sheet, thus prepared, into even a very dilute solution of sugar, and place it under the influence of a temperature of 270° to 300° F.; the part dipped in will change color and

Comptes Rendus, No. 11, 18 Mar., 1850.

will become of a more or less deep black brown.

It remains to point out the solid sheet. We evidently cannot think of using paper, hempen cloths, linen or cotton, whose decomposition would take place simultaneously with that of the sugar; but a woollen tissue, a white merino, for example, may be taken.

After having steeped the merino for three or four minutes in an aqueous solution of bichloride of tin, $SnCl^2 5HO$, made with 100 grammes of bichloride, and 200 grammes of common water, I drain off the liquid and dry the merino on a strip of the same stuff on a sand-bath: the test tissue is then ready. It is cut into strips of 7 to 10 centimetres long and 2 or 3 broad, like ordinary test papers.

By means of this chloridised merino, the physician may, without any trouble, ascertain if the urine of a patient contains an appreciable trace of sugar. It will be sufficient to pour a drop of urine on a strip, and to expose it to heat over a piece of red hot charcoal or the flame of a lamp or candle, to produce in a minute a very distinct black stain. The sensibility of this test is extreme; 10 drops of diabetic urine poured into 100 cubic centimetres of water, form a liquid with which the chloridised liquid is rendered completely black brown. Ordinary urine, urea and uric acid do not give any coloration with the chloride of tin.

QUANTITATIVE ESTIMATION OF FLUORINE.*

BY PROFESSOR H. ROSE.

The best method of estimating fluorine is still by treating the fluorated substance with sulphuric acid, and thus expelling the fluorine. The fluorine is mostly precipitated from solutions as fluoride of calcium. This method, although good, is not perfectly accurate, and it is attended with difficulties, as the precipitated fluoride of calcium frequently separates in a gelatinous form and stops the pores of the filter. This may be avoided by boiling the liquid with the precipitate. The precipitation may be produced by chloride of calcium or nitrate of lime; with the first the precipitate contains no chloride. When the solution containing the fluorine is acid, it has been customary to neutralise it with ammonia before adding the solution of lime; but this plan may cause error, the fluoride of calcium being soluble in ammoniacal salts. The acid solution should therefore be saturated with carbonate of soda before adding the solution of lime. The precipitate, containing fluoride of calcium and carbonate of lime, is calcined, then treated with acetic acid, the whole evaporated to dryness on a water-bath, the dry mass digested with water, and the fluoride of calcium collected on a filter and well washed.

The fluorine may be separated completely from neutral solutions, as fluoride of barium or of lead, so that the amount of fluorine is determinable with perfect accuracy, using for the precipitation either nitrate of baryta or nitrate of lead; then mixing the liquid with an equal quantity of strong alcohol, and washing the precipitate with alcohol. The fluoride of barium may be calcined, but not the fluoride of lead, as it is volatile like chloride of lead; it is dried at 212°. But when the liquid contains both fluorine and chlorides, the precipitates contain chloride of barium and chloride of lead with the fluorides.

When fluorine is present in insoluble compounds, and in only small quantity, it is frequently difficult, by decomposing these compounds with sulphuric acid, to determine its amount; the general plan then is to decompose the compound by fusing with carbonated alkali. But fluoride of calcium and several other insoluble fluorides are not decomposed by fusion with carbonated alkali; they melt, indeed, into a clear liquid; but if, when cooled, the fused mass is treated with water, mere traces of alkaline fluoride are dissolved, and nearly the whole of the fluorine remains in the insoluble residue: but by fusing the fluoride of calcium with carbonated alkali in the presence of silica, decomposition is perfect, an alkaline fluosilicate being first formed, which decomposes by the excess of alkaline carbonate. After cooling, treat the fused mass with water, and precipitate the silica held in solution by carbonate of ammonia. The washed insoluble residue contains not a trace of fluorine, the whole is present with alkaline carbonate in the filtered solution as alkaline fluoride, from which it can be precipitated by a lime salt, as fluoride of calcium.

When phosphates are present with fluorides in insoluble compounds, especially the phosphate of lime, they cannot be decomposed by fusion with carbonated alkali, even with the addition of silica. On the other hand, should the phosphoric acid be combined with alumina, perfect decomposition results, and all the phosphoric acid, together with the whole of the fluorine, and the excess of carbonated alkali, are con-

* *Bericht der Berlin. Acad., Dec.*, 1849.

tained in the solution obtained by treating the calcined mass with water, from which the minute traces of dissolved silica can be precipitated by carbonate of ammonia. The phosphoric acid and fluorine are then precipitated by a lime salt, the carbonate of lime is removed from the precipitate as above described, and the weight of the phosphate of lime and fluoride of calcium together being ascertained, the whole of the precipitate is treated with concentrated sulphuric acid at a gentle heat in a large platinum crucible, until a piece of glass laid over it is no longer acted on: the residue in the crucible is then treated with alcohol, which removes the phosphoric and the excess of the sulphuric acid, leaving the sulphate of lime undissolved, the weight of which is then ascertained. Water is then added to the alcoholic solution, the alcohol expelled by a gentle heat, and the phosphoric acid then thrown down as ammonio-phosphate of magnesia. From the loss in weight found on comparing the combined weight of the phosphoric acid and lime with that of the original precipitate, the amount of fluorine in it can be calculated; for it is to this loss in weight, as the equivalent of fluorine is to the equivalent of fluorine less the atomic weight of oxygen.

In solutions containing an alkaline fluoride and alkaline phosphates, the phosphoric acid may be removed by a solution of basic protonitrate of mercury. With a solution of an alkaline fluoride, the latter yields a copious yellowish precipitate, insoluble in the solution of the fluoride, but soluble in an excess of the solution of protoxide of mercury; only the phosphoric acid, therefore, is precipitated by the latter. The precipitate is dried, mixed with carbonate of soda, and, in order to determine the quantity of phosphoric acid present, is treated as described by the author in a former paper.

The separation of sulphates from fluorides is difficult. Heavy spar and fluor spar are found mixed in nature; but it is impossible to effect a separation in this mixture by treating it with hydrochloric or nitric acid, as might be expected. The undissolved sulphate of baryta contains some fluoride of barium after treatment with these acids and washing with water, and also some sulphate of lime if not sufficiently washed. A decomposition takes place in a mixture of sulphate of baryta and fluoride of calcium by the action of hydrochloric acid, similar to what occurs in a mixture of sulphate of baryta and chloride of calcium at a red heat; the fluoride of barium dissolved in the acid is reconverted into sulphate of baryta by the sulphate of lime dissolved at the same time. But if the insoluble precipitate is washed with dilute hydrochloric acid instead of pure water, the acid will at length dissolve out the whole of the fluoride of barium; but then it is difficult to remove the sulphate of lime from it, so that the determination of the sulphate of baryta can never be depended upon as accurate.

As sulphate of baryta and fluoride of calcium cannot be separated in the humid way by treatment with hydrochloric acid, the mixture should be decomposed by fusion with carbonated alkali and the addition of silicic acid: when the fused mass is cold it is treated with water, the silica precipitated by carbonate of ammonia, the alkaline liquid supersaturated with hydrochloric acid and precipitated by chloride of barium. The amount of sulphate of baryta is obtained correctly, and free from fluoride of barium.

ON THE COMPOSITION OF MELLON AND THE MELLONIDES.*

BY M. CH. GERHARDT.

Some years ago, I assailed, as tainted with error, the theory accordig to which mellon is regarded as a compound radical similar to cyanogen, and the mellonides, salts similar to the cyanides. In a work which I published on this subject in conjunction with M. Laurent, it was, indeed, demonstrated that mellon, besides carbon and nitrogen, contains 1·5 per cent. of hydrogen; so that its composition is

$$C^6 N^9 H^3$$

and not $C^6 N^9$ as was previously supposed. We have since repeated the analysis of this body, prepared by the calcination of the sulphocyanide of mercury, and we have arrived at the same result: it is that this sulphocyanide, like many other salts of mercury, contains water of crystallisation which cannot be removed from it without decomposing it.

It is also stated in the same memoir, that by acting with boiling potassa on mellon, hydromellonic acid is not produced, but another acid, which is tribasic, and contains

$$C^6 N^8 H^4 O^3$$

As to the composition of the mellonides, which are obtained by mellon and sulphocyanide of potassium at a red heat, we reserved the question, not having sufficient

* *Comptes Rendus*, No. 11, March 18, 1850.

will become of a more or less deep black brown.

It remains to point out the solid sheet. We evidently cannot think of using paper, hempen cloths, linen or cotton, whose decomposition would take place simultaneously with that of the sugar; but a woollen tissue, a white merino, for example, may be taken.

After having steeped the merino for three or four minutes in an aqueous solution of bichloride of tin, $SnCl^2 5HO$, made with 100 grammes of bichloride, and 200 grammes of common water, I drain off the liquid and dry the merino on a strip of the same stuff on a sand-bath: the test tissue is then ready. It is cut into strips of 7 to 10 centimetres long and 2 or 3 broad, like ordinary test papers.

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* *Bericht der Berlin. Acad., Dec.*, 1849.

tained in the solution obtained by treating the calcined mass with water, from which the minute traces of dissolved silica can be precipitated by carbonate of ammonia. The phosphoric acid and fluorine are then precipitated by a lime salt, the carbonate of lime is removed from the precipitate as above described, and the weight of the phosphate of lime and fluoride of calcium together being ascertained, the whole of the precipitate is treated with concentrated sulphuric acid at a gentle heat in a large platinum crucible, until a piece of glass laid over it is no longer acted on: the residue in the crucible is then treated with alcohol, which removes the phosphoric and the excess of the sulphuric acid, leaving the sulphate of lime undissolved, the weight of which is then ascertained. Water is then added to the alcoholic solution, the alcohol expelled by a gentle heat, and the phosphoric acid then thrown down as ammonio-phosphate of magnesia. From the loss in weight found on comparing the combined weight of the phosphoric acid and lime with that of the original precipitate, the amount of fluorine in it can be calculated; for it is to this loss in weight, as the equivalent of fluorine is to the equivalent of fluorine less the atomic weight of oxygen.

In solutions containing an alkaline fluoride and alkaline phosphates, the phosphoric acid may be removed by a solution of basic protonitrate of mercury. With a solution of an alkaline fluoride, the latter yields a copious yellowish precipitate, insoluble in the solution of the fluoride, but soluble in an excess of the solution of protoxide of mercury; only the phosphoric acid, therefore, is precipitated by the latter. The precipitate is dried, mixed with carbonate of soda, and, in order to determine the quantity of phosphoric acid present, is treated as described by the author in a former paper.

The separation of sulphates from fluorides is difficult. Heavy spar and fluor spar are found mixed in nature; but it is impossible to effect a separation in this mixture by treating it with hydrochloric or nitric acid, as might be expected. The undissolved sulphate of baryta contains some fluoride of barium after treatment with these acids and washing with water, and also some sulphate of lime if not sufficiently washed. A decomposition takes place in a mixture of sulphate of baryta and fluoride of calcium by the action of hydrochloric acid, similar to what occurs in a mixture of sulphate of baryta and chloride of calcium at a red heat; the fluoride of barium dissolved in the acid is reconverted into sulphate of baryta by the sulphate of lime dissolved at the same time. But if the insoluble precipitate is washed with dilute hydrochloric acid instead of pure water, the acid will at length dissolve out the whole of the fluoride of barium; but then it is difficult to remove the sulphate of lime from it, so that the determination of the sulphate of baryta can never be depended upon as accurate.

As sulphate of baryta and fluoride of calcium cannot be separated in the humid way by treatment with hydrochloric acid, the mixture should be decomposed by fusion with carbonated alkali and the addition of silicic acid: when the fused mass is cold it is treated with water, the silica precipitated by carbonate of ammonia, the alkaline liquid supersaturated with hydrochloric acid and precipitated by chloride of barium. The amount of sulphate of baryta is obtained correctly, and free from fluoride of barium.

ON THE COMPOSITION OF MELLON AND THE MELLONIDES.*

BY M. CH. GERHARDT.

Some years ago, I assailed, as tainted with error, the theory accordig to which mellon is regarded as a compound radical similar to cyanogen, and the mellonides, salts similar to the cyanides. In a work which I published on this subject in conjunction with M. Laurent, it was, indeed, demonstrated that mellon, besides carbon and nitrogen, contains 1·5 per cent. of hydrogen; so that its composition is

$$C^6\ N^9\ H^3$$

and not $C^6\ N^8$ as was previously supposed. We have since repeated the analysis of this body, prepared by the calcination of the sulphocyanide of mercury, and we have arrived at the same result: it is that this sulphocyanide, like many other salts of mercury, contains water of crystallisation which cannot be removed from it without decomposing it.

It is also stated in the same memoir, that by acting with boiling potassa on mellon, hydromellonic acid is not produced, but another acid, which is tribasic, and contains

$$C^6\ N^8\ H^4\ O^2$$

As to the composition of the mellonides, which are obtained by mellon and sulphocyanide of potassium at a red heat, we reserved the question, not having sufficient

* *Comptes Rendus*, No. 11, March 18, 1850.

of the product to determine it. One fact, however, seemed to flow from our experiments, namely, *the presence of hydrogen in the dry mellonides*, amongst others in the mellonide of silver dried at 284° F.

Notwithstanding the numerous arguments we have adduced, chemists nevertheless continue to regard mellon and the mellonides as non-hydrogenous bodies.

The question now appears to me to be settled. M. Henneberg has just published experiments which, I think, decide most completely in favor of my opinion: this chemist has, indeed, ascertained, *that mellon and the mellonides give identically the same acid with boiling potassa, disengaging ammonia.* But M. Henneberg is mistaken as to the composition of this acid, which is the one which M. Laurent and I represented by the formula

$$C^6 N^3 H^4 O^2$$

its neutral salts being

$$C^6 N^3 H M^2 O^2$$

I beg chemists to verify for themselves these proportions, which they will find correct, and which demonstrate, in my opinion:—

1. That mellon is the imide (salt of ammonia minus 2 equivalents of water) of the foregoing acid, and presents, consequently, the composition

$$C^6 N^9 H^3$$

assigned to it by M. Laurent and myself.

2. That the mellonides are compounds similar to the metallic salts obtained with many imides, (for example, with phtalimide and succimide) that is to say, that the mellonides represent mellon in which H^2 is replaced by M^2

Mellonides ..... $C^6 N^9 HM^2$

3. That, consequently, the dualistic theory of mellon and the mellonides is devoid of foundation, as I have always maintained.

RESEARCHES ON SOME LIGHT OILS OBTAINED IN THE DISTILLATION OF WOOD.*

BY M. A. CAHOURS.

When water is poured into the crude wood spirit of commerce, a fluid oil of a pale yellow color separates and floats on the surface. This oil does not constitute a pure and definite proximate product; indeed, when it is submitted to distillation, it is observed that it begins to boil towards 194° F., whilst the latter portions distil only towards 392° F. The elementary analysis and the vapor-density leading to nothing definite as regards any of these products, I conceived the idea of agitating the crude oil with concentrated sulphuric acid; I thus obtained a viscid mass of a red brown, which floated on a clear liquid of an aromatic odor. The latter, washed with an alkaline ley, diluted, dried over fused chloride of calcium, then distilled over anhydrous phosphoric acid, begins to boil at 238° F.; the last portions distil over between 320 and 340° F. A considerable portion of this product passes over by distillation at from 227 to 234° F.; I put this on one side. I likewise obtained other fixed points: one, at from 262 to 266° F.; another from 293 to 298° F.; and the last from 327 to 334° F.

The product which boils between 227 and 234° F. is toluene (benzoene of Deville)

$$C^{14}H^8.$$

The mean of several vapor-densities is 3·27, representing 4 volumes of vapor, and agrees perfectly with the theoretical density 3·24. In order to completely demonstrate the identity of this product with toluene, I treated it with fuming nitric acid. I thus obtained mononitric and binitric toluene. The first, treated by an alcoholic solution of hydrosulphate of ammonia, yielded toluidine endowed with all the properties which Dr. Hofmann assigns to it; the second is converted, under the influence of the same reagent, into a new alkaloïd, the formation of which I have already noticed in a note relative to anisol; it is nitric toluidine, whose formula is

$$C^{14}H^8N^2O^4.$$

This alkaloid, which crystallises in yellow needles, gives, with hydrochloric, nitric, sulphuric and phosphoric acids well defined compounds, to which analysis assigns the formulæ

Hydrochlorate ClH, $C^{14}H^8N^2O^4$;
Nitrate..... NO^5, $C^{14}H^8N^2O^4$, HO;
Sulphate..... SO^3, $C^{14}H^8N^2O^4$, HO.

Treated by chloride of benzoïle and cumyle, it gives also compounds analogous to the amides and anilides.

The product which boils at between 262 and 266° F. presents many points of analogy with toluene; it differs from it, in composition, only in containing additionally C^2H^2: it is therefore an homologue of that body. Several analyses and three densities agreeing perfectly among themselves led to the formula

$$C^{16}H^{10}=4 \text{ volumes of vapor.}$$

I shall designate it under the name of *xylene*. Treated by fuming nitric acid, this body gives products analogous to those furnished by toluene. *Mononitric xylene*,

* *Comptes Rendus*, No. 11, March, 18, 1850.

dissolved in alcohol and treated by hydrosulphate of ammonia, gives a base analogous to toluidine, which I designate under the name of xylidine.

The liquid which boils at 298° F. presents the composition and all the properties of cumene

$$C^{18}H^{12}.$$

The analyses and vapor-density agree perfectly with this formula. In order to demonstrate the identity of this substance with cumene, I treated it with fuming nitric acid; I obtained two compounds which present all the properties of mononitric and binitric cumene: these, treated by hydrosulphate of ammonia, furnished cumidine and nitric cumidine.

On this occasion, I thought it necessary again to examine mesitylene, which was studied by Sir Robert Kane, to whom is due its discovery as the radical of the compounds derived from acetone. Having admitted, according to Sir R. Kane's researches, that pure mesitylene boils between 266 and 275° F., I prepared this product ten years ago, and the determination of the vapor-density of this substance, which was only a mixture, led me to double Sir R. Kane's formula. Dr. Hofmann's recent investigations on this subject, having led him to triple the formula of this compound, I thought it necessary to resume these investigations. Consequently, I prepared this product in large quantity. The larger quantity of liquid obtained boils between 323 and 327° F. The vapor-density of this product, taken twice with different samples, furnished numbers perfectly agreeing with each other, which lead to the formula

$$C^{18}H^{12}$$

admitted by Dr. Hofmann. It is therefore an isomeric compound of cumene, but not identical with that body; for, besides that its boiling point differs from it considerably, it gives, by its contact with reagents, entirely different products. Under the influence of fuming nitric acid, three distinct products are obtained, namely:—

1. Mononitric mesitylene, by avoiding the employment of an excess of nitric acid, and especially by cooling the reacting matters with care.

2. By employing more nitric acid and allowing the temperature to increase, binitric mesitylene is obtained, the discovery of which is due to Dr. Hofmann.

3. Finally, by replacing the nitric acid with a mixture of nitric acid and fuming sulphuric acid, trinitric mesitylene is obtained, whose formation and properties I described in a work relative to the action of the mixture of fuming sulphuric and nitric acids on organic matters.

Mesitylene gives rise, in its contact with nitric acid, to three products derived by the substitution of hyponitric vapor for hydrogen, the formulæ of which may be thus expressed:—

$$C^{18}\,H^{11}(NO^4),$$
$$C^{18}\,H^{10}(NO^4)2,$$
$$C^{18}\,H^{9}(NO^4)3.$$

The first of these bodies, mononitric mesitylene, being treated by an alcoholic solution of potassa, heats and disengages two products by distillation: one, liquid, which is obtained only in minute proportions, possesses alkaloid properties; the second, which is solid, very readily dissolves in alcohol and is separated, by spontaneous evaporation, under the form of a table of great beauty.

Submitted to analysis, this product gave results which lead to the formula

$$C^{18}\,H^{11}(NO^4).$$

It is therefore an isomer of mononitric mesitylene.

As to the last hydrocarbon obtained in the treatment of the volatile oil of wood by sulphuric acid and which boils between 327 and 334° F., it has exactly the same composition as cumene and mesitylene; it presents, besides, the same state of condensation as those bodies, without being identical with either.

The volatile oil formed in the solution of the wood spirit, and which impregnates the wood spirit of commerce, contains, therefore, the same hydrocarbons as those which are produced in the distillation of coal tar, and which have recently been examined in Dr. Hofmann's laboratory, by Mr. Charles Mansfield. These results establish, therefore, an intimate connection between pit coal and the ligneous matter which may be regarded as its starting point. I found, in certain samples of wood spirit, an oil much more volatile than the foregoing; it begins to boil at 136° F., and the last portions distilled at from 194 to 212° F. This very volatile oil is composed almost entirely of two substances; the first, which constitutes about three-fourths of it, is acetate of methyline, as I proved by elementary analysis, its vapor-density and the employment of reagents; the other possesses the properties and composition of M. Fremy's metacetone, $C^{12}H^{10}O^2$=4 volumes of vapor.

ON THE EXISTENCE OF IODINE IN FRESH WATER PLANTS. CONSEQUENCES OF THIS FACT IN GEOGNOSY, VEGETABLE PHISIOLOGY, THERAPEUTICS, AND, PERHAPS, IN MANUFACTURES.*

BY M. AD. CHATIN.

THE verification of the fact mentioned by Muller, *(Lindley, The Vegetable Kingdom*, p. 363), that iodine was present in a Cress of an unknown origin, led me to discover:—

That iodine exists in fresh water cresses, and that this is not a fact peculiar to this species, nor general among the Cruciferæ;

That iodine is entirely wanting, at least it has never been found in terrestrial plants, whilst it exists in all aquatic plants;

That, amongst these last, those which live in running streams are more rich in iodine than those that inhabit stagnant waters;

That, in sheets of water of sufficient extent to be agitated by the wind, the plants resemble in this respect those in the running water;

That the proportion of iodine in plants, is, in general, independent of their nature, and only subordinate to their habitat, as proved by the Confervæ, Potamogetons, Nymphœa, Ranunculi, and Cresses all equally rich in iodine in running water, all equally poor in marshy places;

That the iodine is not combined with the tissue, but exists as an alkaline iodide dissolved in the sap.

Among the plants analysed, and on which the above results are founded, we may mention the following:—

Alyssum saxatile, Brassica oleracea, Capsella Bursa-pastoris, Erysimum, Cheiranthus Cheiri, Cochlearia armoræcea, Raphanus sativus; land Cruciferæ which contain no iodine.

Nasturtium officinale, Nasturtium amphibium, Conferva crispata, Chara fœtida, Fontinalis antipyretica, Typha angustifolia and minima, Scirpus Lacustris, Arundo Phragmites, Acorus calamus, Saggittary, Nymphœa, Potamogeton crispum and pectinatum, water pepper, *Beccabunga, Phellandrium aquaticum, Gratiola*, water Ranunculus, Comfrey and Elecampane, Cruciferæ and various aquatic plants containing more or less iodine.

Whence comes the iodine found in fresh water plants? Do they form it themselves? Undoubtedly not. Does it come from the salt-springs, from the mineral sources in which Angelini, Cantu, O. Henry, etc., have mentioned its presence? It is impossible, because it is found not only in the plants of the great rivers, such as the Seine, Marne and Isère, but likewise in those of every rivulet, pond and marsh. It comes, as we are led to conclude, from every point of the soil in which it accompanies the chlorides, with which it is extracted by the washing of the waters. That if the plants of the running waters contain more iodine than those of stagnant waters, it is because they imbibe it from a reservoir, where, when the iodine is exhausted, it is immediately replaced by a liquid which has all its original richness.

But how does the iodide find its way into the plant? Is it by the surface, and does it separate it by a peculiar action, as it separates the oxygen, in the act of respiration, according to the ingenious theory of M. Ad. Brongniart? Or does it penetrate with the water, either by the surface or by the roots, to fix and concentrate among the tissues by the exhalation of this same water, thus subverting the ideas of M. Dutrochet on the non-transpiration of water plants?

Amongst the applications of these researches to therapeutics may be found the causes of the anti-scorbutic anti-tuberculous properties known to belong to the Phellandria, Cresses, Beccabunga, etc., and the preference given to those plants which grow in running waters, as well as the reason of prescribing, as a preventive, the use of aquatic plants to persons who inhabit countries in which goitres are endemic. Washings of the ashes might be made useful in this point of view, supposing that it would not be advantageous to extract the iodine.

The analyses were made by carefully incinerating the plants, washing the ashes with boiling water, and detecting the iodine by the aid of starch, by sulphuric acid, nitric acid, and nitrate of potassa and sulphuric acid. The discoloration of liquors and the volatilisation of iodine by the application of heat, were always employed as a counter proof. According to their richness in iodine, the plants furnish either an instantaneous and intense violet, or the same color after a certain time, on a purple violet tint, either immediate or after a greater or less time.

It is necessary, in performing these operations, to guard against some dangers, such as the loss of part of the iodine when the plant to be incinerated has not been moistened with a solution of caustic potassa,

* *Comptes Rendus*, No. 12, March, 1850.

and the inconvenience which results from the fusibility communicated to the ash by this addition; the property which saline mixtures, especially those rich in carbonates, have, of concealing reactions more or less completely, above all that of chlorine; the sudden disappearance of iodine from solutions if either too hot or too concentrated, and its non-manifestation in liquors a little too diluted, etc.

ON DULCOSE, A HOMOLOGUE OF GRAPE-SUGAR.*

BY M. A. LAURENT.

In the year 1843, M. Ch. Gerhardt formed the idea of comparing the properties of organic substances with their composition, setting aside all hypotheses concerning the arrangement of the atoms, and he arrived at this conclusion:—

If two bodies have a certain composition that that of the one can be represented by that of the other plus n-times CH^2, *these two bodies will possess analogous properties (except in cases of isomerism).* Thus formic, acetic, and metacetic acids possess analogous properties, because they contain O^2+CH^2, O^2+2CH^2, O^2+3CH^2. It is the same with the hydrogurets of benzoyle and cumyle, the benzoic and cuminic acids, whose composition is represented by—

Hydrogurets C^7H^6O, $C^7H^6O+3CH^2$.
Acids..... $C^7H^6O^2$, $C^7H^6O^2+3CH^2$.

M. Gerhardt calls all those bodies *homologues* which differ from one another only by nCH^2.

As the most striking examples which he first adduced were derived from the series of compounds formed by the spirits of wood, wine, and potatoes, and as the analogy of these substances was already sufficiently explained either by the theory of radicals or by the numerical relations which I had pointed out in that series, chemists paid no attention to homology, looking upon it as a classification under the form of a dictionary.

However, during the last year or two, new examples of homology have been discovered among some bodies possessed of rather singular properties, and in all cases the analogy of the properties has been evident. I will merely mention a few of the most remarkable. Sarcosine, leucine and glycocolle are bodies which are extracted from flesh, and which possess much analogy; the composition which was assigned to them did not render them homologues. In conjunction with M. Gerhardt I have repeated the analyses of the two latter, and we have found that all three conform to the law of homology.*

* M. Mulder, to whom we owe the first analyses of leucine, disputes our formula; but our analyses have been confirmed by those of Cahours and Strecker. M. Mulder has already confessed to the error which he had committed on glycocolle. We do not despair therefore of seeing him adopt our formula for leucine.

The bile of the pig contains an acid, which is homologous with the acid contained in ox-bile.

Salicylic and anisic acids give rise to two grand series of compounds. The starting-points having been corrected by my analyses, and M. Gerhardt having signalized them as homologues, the homology has held good in all the derived substances, as M. Cahours has recently shown. The organic alkali contained in tea and that which occurs in cacao have been found homologous.

Mannite is found to have considerable analogy with erythromannite, obtained by Dr. Stenhouse from certain coloring lichens. But this chemist assigns to the latter substance a formula which has no kind of homology with mannite. M. Gerhardt, supposing a slight error in the analysis of this substance, considers that it should be viewed as a homologue of mannite. But, on this hypothesis, nitric acid would furnish with erythromannite a sexnitrated substance, the only example known in organic chemistry. Recently however M. Strecker has proved, by fresh analyses, that nitromannite itself is sexnitrated, and not quinquinitrated, as had been supposed.

I have now a very remarkable example to add to the list of homologues; it is a new species of sugar, which comes from Madagascar, the origin of which however is not well known, crystallized in oblique rhombic prisms. It has a slight sweetish taste, and diffuses on incandescent charcoal the same odor as sugar. From its composition it is homologous with grape-sugar. Deprived of water by fusion, it contains $C^{14}H^{28}O^{12}$;

deducting C^2H^4,

we have $C^{12}H^{24}O^{12}$, or grape-sugar. Redissolved in water, it absorbs 3 atoms.

Like grape-sugar, it acts the part of a weak polybasic acid, for it can exchange 4 atoms of hydrogen for 4 atoms of barium, furnishing a well crystallized salt, which contains $C^{14}H^{24}Ba^4O^{12}+14Aq$.

The action which nitric acid exerts upon it is interesting. It is well known that the homologous bodies of the grand series nCH^2

* *Comptes Rendus*, No. 3, Jan. 21, 1850.

yield with oxidizing agents the homologous acids of that series. It is likewise known that grape-sugar furnishes with nitric acid saccharic acid, whilst the gums and milk-sugar, which are so closely related to grape-sugar, give mucic acid, which is isomeric with saccharic acid. Now the new substance is likewise converted into mucic acid by the action of nitric acid.

According to M. Biot, it exerts no action on polarized light; and according to M. Soubeiran, it does not undergo alcoholic fermentation.

NOTE ON DULCOSE AND ON BROMOBENZOIC AND CHRYSAMMIC ACIDS.*

BY M. AUG. LAURENT.

M. SOUBEIRAN thinks, from analyses made in his laboratory, that the body which I have designated under the name of dulcose is only mannite.

This character obviates all confusion of these two substances:—a boiling alcoholic solution of mannite, on cooling, is entirely filled with long and fine needles. Dulcose, on the contrary, is almost insoluble in alcohol, and separates from it under the form of small and very short crystals, which in no way resemble those of mannite.

M. Soubeiran adds that, at all events, dulcose cannot be a kind of sugar, since it does not undergo alcoholic fermentation.

I will not recur to the criticisms which I have already made on the classification of organic compounds;—a classification whose method is derived almost entirely from the drug trade; I will confine myself to remarking that, according to the ordinary definition of sugars, carbinic ether should be ranked among these bodies.

M. Muller mentioned, at the last sitting of the Academy, an experiment which, in his opinion, is unfavorable to my ideas. Has M. Muller analysed his compound? I doubt it; for if he had, he would certainly have found a different result from that which he announces.

If M. Muller is so much disposed to prove that my ideas are false, I will furnish him with an opportunity of ascertaining it.

Pure chrysammic acid is represented by ..... $C^{14}N^4O^{12}H^4$
Chrysammide ..... $C^{30}N^{10}O^{25}H^{12}$
or by ..... $C^{14}N^5O^{11}H^3$
Chrysammamic acid ..... $C^{14}N^5O^{11}H^5$
A'oeresinic acid ..... $C^{12}N^4O^{10}H^{10}$
Aloetic acid ..... $C^{16}N^4O^{13}H^8$
Hydrochrysamide ..... $C^{14}N^4O^6H^{12}$

Dualism agrees with all these formulæ, which, for the most, appear to me false. I think that we should have the following compounds by adopting M. Muller's formula for chrysammic acid, which I will call quadri-nitrated chrysic acid:—

Chrysammic acid, or quadri-nitrated chrysic acid ..... $C^{14}X^4H^4O^4$;
Chrysammamic acid, chrysamic acid ..... $C^{14}X^4H^5ONO^3$;
The same hydrate $+Aq$;
Chrysammamide, or chrysamate of ammonium $C^{14}X^4H^4AmNO^3$;
True chrysamide being.. $C^{14}X^4H^6N^2O^2$;
Hydrochrysamide ..... $C^{14}(XAd^3)H^4O^4$;
Aloetic acid should contain $C^{16}X^4H^8O^4$.

This acid should also be converted into quadri-nitrated acid and into oxalic acid, under the influence of nitric acid. We have

$$C^{16}X^4H^8O^4+O^5=C^{14}X^4H^4O^4+C^2H^2O^4+H^2O.$$

As picric acid is also formed in this reaction, we on the other hand

$$C^{16}X^4H^8O^4+2HOX+O=2C^6H^3X^3O+C^2H^2O^4+H^2O.$$

(nitric — picric)

As to aloeresinic acid, it should contain, as M. Gerhardt has already said, $C^6H^4X^2O^2$.

M. Muller may also analyse the sulphosulphetheric, xylitic, hydroleïc, metoleïc, metamargeric, humic, geïc, palmitonic acids, nitrate of anthracenise, nitrobenzoïde, the sulphurets of xuthene and phaiene, resineïne, resineone, &c., &c.; and if he confirms the accuracy of a single formula of these bodies, I consent to abandon the ideas which I defend.

NOTE CONCERNING ANHYDROUS BROMOBENZOIC ACID.*

BY M. MULLER.

IN order to sustain his views relating to dualism, M. Laurent has principally relied on the non-existence of the anhydrous acids and on the law of equal numbers. But on the other hand, M. Fremy has shown that the salts contain anhydrous acids, since the latter may be displaced by other anhydrous acids; a fact which does not seem to be reconcilable with the opinion of M. Laurent, and it is the same, it seems to me, with that which I now submit to the Academy.

It is known that M. Peligot has obtained bromobenzoic acid by making bromine act on benzoate of silver. But M. Peligot's acid being anhydrous, it could only be formed under the influence of water. In

* *Comptes Rendus*, No. 12, 25 March, 1850.

* *Comptes Rendus*, No, 11, 18 March, 1850.

order to obtain the anhydrous acid, I combined bromine with dry benzoate of silver, and I heated the product in a retort; distillation furnished a bromuretted acid which, dissolved in water, possessed the properties of M. Peligot's acid.

I represent the reaction by the following equation:—

$$C^{14}H^{10}O^3+AgO+Br^4=C^{14}H^9BrO^4+Br^3Ag-HBr;$$

It shows that it can only be formed of anhydrous bromobenzoic acid, and that in the latter the whole of the bromine and hydrogen is not a multiple of four.

MODE OF PREPARING THEÏNE.*

BY H. HEIJNSIUS.

Dr. Stenhouse has recommended the preparation of theïne from the extract of tea, according to Mohr's method. The following is still more simple:—Old, spoiled tea is placed in an iron pot, which is covered with filtering paper, and the whole then covered with a cylindrical paper cap. The temperature is now cautiously and gradually raised, when a sufficient quantity of pure theïne will be found to have collected on the paper.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

THE EXPOSITION OF INDUSTRY OF ALL NATIONS TO BE HELD IN LONDON IN 1851.

Our readers will find stitched in the wrapper of the present No. of The Chemist a synopsis of the Plan of this extraordinary exhibition.

We have awaited the publication of this plan by Her Majesty's Commissioners to address to our readers an earnest exhortation to prove that Chemistry in this country is at least not less advanced than on the continent.

This exhibition will be, perhaps, the greatest event of the Nineteenth Century. That a nation whose manufactures and commerce constitute her wealth and her glory—rising above the meanness of jealousy into a noble spirit of generous rivalry—should in the most perfect amity invite all the world to pour the multifarious productions of its mighty and varied genius into one common treasury, there to compete with that nation's own productions for prizes of its own bestowing, is a circumstance unparalleled in the history of the world. The collection of animals by Alexander the Great—mighty as was that undertaking in the then condition of the world—sinks into insignificance before this.

Great, indeed, is the debt of gratitude we owe to the illustrious person by whom this exposition was suggested. Always foremost in every undertaking calculated to confer considerable benefit on this country, he must and will reap a rich harvest of thanks from a grateful people, and from the delightful internal consciousness of having done more than any man in any position in Society to advance the great pursuits of life. The Sciences, the Arts will owe much to His Royal Highness the Prince Consort, not only for his magnificent suggestion, but for his earnest, energetic endeavors to carry it out. When the unsparing hand of Time shall have removed from the busy scenes of life all who now take an active part in, or witness with admiration the development of the grand design, shall his name be revered by future generations: his fame, indeed, will be inscribed on a "monumentum ære perennius," the imperishable history of the world.

We cannot depict the advantages to be expected from the Exposition better than in His Royal Highness' own words. We

* *Scheik Onderzoek*, v, 318.

quote from his eloquent speech at the Banquet given on the 11th of March, by the Lord Mayor of London to the Prince, Her Majesty's Commissioners, and the mayors and other chief corporate officers of England, Ireland and Scotland.

"It must, indeed, be most gratifying to me to find that a suggestion which I had thrown out, as appearing to me of importance at this time, should have met with such universal concurrence and approbation; for this has proved to me that the view I took of the peculiar character and requirements of our age was in accordance with the feelings and opinions of the country. Gentlemen, I conceive it to be the duty of every educated person closely to watch and study the time in which he lives, and, as far as in him lies, to add his humble mite of individual exertion to further the accomplishment of what he believes Providence to have ordained. Nobody, however, who has paid any attention to the particular features of our present era will doubt for a moment that we are living at a period of most wonderful transition, which tends rapidly to accomplish that great end—to which indeed all history points—the realisation of the unity of mankind. Not a unity which breaks down the limits and levels the peculiar characteristics of the different nations of the earth, but rather a unity the result and product of those very national varieties and antagonistic qualities. The distances which separated the different nations and parts of the globe are gradually vanishing before the achievements of modern invention, and we can traverse them with incredible speed; the languages of all nations are known, and their acquirement placed within the reach of everybody; thought is communicated with the rapidity, and even by the power, of lightning. On the other hand, the great principle of the division of labor, which may be called the moving power of civilisation, is being extended to all branches of science, industry, and art. Whilst formerly the greatest mental energies strove at universal knowledge, and that knowledge was confined to the few, now they are directed to specialities, and in these again even to the minutest points. But the knowledge acquired becomes at once the property of the community at large; whilst, formerly, discovery was wrapt in secresy, it results from the publicity of the present day that no sooner is a discovery or invention made than it is already improved upon and surpassed by competing efforts. The products of all quarters of the globe are placed at our disposal, and we have only to choose which is the best and cheapest for our purposes, and the powers of production are intrusted to the stimulus of competition and capital. So man is approaching a more complete fulfilment of that great and sacred mission which he has to perform in this world. His reason being created after the image of God, he was to use it to discover the laws by which the Almighty governs His creation, and, by making these laws his standard of action, to conquer Nature to his use—himself a divine instrument. Science discovers these laws of power, motion, and transformation; industry applies them to the raw matter which the earth yields us in abundance, but which becomes valuable only by knowledge; art teaches us the immutable laws of beauty and symmetry, and gives to our productions forms in accordance with them. Gentlemen, the exhibition of 1851 is to give us a true test and a living picture of the point of developement at which the whole of mankind has arrived in this great task, and a new starting point from which all nations will be able to direct their further exertions. I confidently hope that the first impression which the view of this vast collection will produce on the spectator will be that of deep thankfulness to the Almighty for the blessings which he has bestowed upon us already here below; and the second, the conviction that they can only be realised in proportion to the help which we are prepared to render to each other—therefore only by peace, love, and ready assistance, not only between individuals, but between

the nations of the earth. This being my conviction, I must be highly gratified to see here assembled the magistrates of all important towns in this realm, sinking all their local, and possibly political differences —the representatives of the different political opinions of the country, and the representatives of the different foreign nations—to-day representing only one interest. Gentlemen, my original plan had been to carry out this undertaking with the help of the Society of Arts of London, which had long and usefully labored in this direction, and by the means of private capital and enterprise. You have wished it otherwise, and declared that it was a work which the British people as a whole ought to undertake. I at once yielded to your wish, feeling that it proceeded from a patriotic, noble, and generous spirit. On your courage, perseverance, and liberality the undertaking now entirely depends. I feel the strongest confidence in these qualities of the British people, and am sure that they will repose confidence in themselves—confidence that they will honorably sustain the contest of emulation, and will nobly carry out their proffered hospitality to their foreign competitors. We, Her Majesty's Commissioners, are quite alive to the innumerable difficulties which we shall have to overcome in carrying out the scheme; but having confidence in you, and in our own zeal and perseverance at least, we require only your confidence to make us contemplate the result without any apprehension."

On the present occasion we cannot devote sufficient space to enter very fully into all matters connected with the chemical portion of the intended Exposition; but we shall from time to time supply our readers with the fullest and most authentic information as to the proceedings of Her Majesty's Commissioners, and shall point out, as far as in us lies, the best objects to which those who intend to exhibit can devote their attention. We are aware that extensive preparations are being made by eminent manufacturing chemists in this country and on the continent for the production of specimens, and we trust that our countrymen will make a respectable figure.

We hope that the Royal Commissioners will lose no time in laying before the public a list of the judges by whom the prizes are to be awarded. As regards the judges of the Chemical department, we hope that they will be numerous, and selected quite independently of their interest or influence —competency alone being the basis of their appointment. We feel convinced that on the character of these judges, the success of this branch will very greatly depend. They must consist, not of those who have elbowed their way into high places, raised, not by their merit, but by their presumption their lack of that modesty which too often induces real merit to shrink from striving for those honors and emoluments which the ignorant pretender too frequently by sheer impudence secures,—but of such men as by laborious practice have acquired that knowledge which is denied to all who will not seek it in that manner. Men of practical knowledge will not submit their productions to the judgement of those who are inferior to them in their own department. The judges in Chemistry must be somewhat numerous, as many thousands of rare products will be submitted to their judgement, and they must be eminent from their discoveries, and well known to be practically acquainted with the matters on which they will have to pass judgment. We shall look forward with anxiety to the publication of lists of the judges, as we feel convinced that if there be any indiscretion in their appointment, the whole thing must prove a failure, as exhibitors would set no value on distinctions conferred by their inferiors. We shall scrutinise the list most severely, and if we find in it any pretenders, shall unhesitatingly and uncompromisingly set about demolishing their pretensions. We are sincerely anxious for the success of the undertaking, and should be grieved indeed to find in the selection of the judges an element of failure.

Such of our numerous readers as intend to exhibit are assured that it will afford us the most sincere pleasure to aid their views in any way in our power which they can point out. As journalists, we have made it our business to acquire the power of affording aid to an extent which no private person can command. The offer is made with the view of assisting in the great work of upholding the chemical reputation of our country, and we shall be truly gratified if we can afford any assistance to even one person.

ON THE ALLOYS OF GOLD AND SILVER USED IN THE MANUFACTURE OF JEWELLERY, PLATE, &c., WITH AN EXPOSITION OF THE VARIOUS FRAUDS PRACTISED THEREIN.

BY WILLIAM GRIFFITHS, WORKING GOLDSMITH.

LETTER IV.

To the Editors of The Chemist.

DEAR SIRS,—I concluded my last letter with the processes employed to produce the "fine gold color" on 18 carat gold; the next alloy worked is the 16 carats.

It is the compound of the metals generally used for the manufacture of neckchains, bracelets, and, indeed, almost all the work retailed* under the name of *fine gold*. It has that peculiar dead pale yellow color in its releivo by which we are able to distinguish it; we call it "wet colored work." In testing, it may be known by removing the upper or purified layer of its surface with a sharp instrument, when it presents a dark red surface underneath, which can be very slightly acted on with nitric acid; as to produce the required color quickly there is a great amount of copper in proportion present, it should contain :—

	oz.	dwt.	grs.
Gold	0	13	8
Silver	0	2	8
Copper	0	4	8
	1	0	0

* By this expression I mean work sold casually by shopkeepers, and not ordered or bespoke from a manufacturer, who, of course, makes the work of the quality he is paid for.

These metals are fused together in the same way as before described—the silver and copper first, the gold added when the inferior metals are perfectly fused. This alloy, unless very carefully melted, is difficult to work, on account of the great inequality of the proportions of the materials; it is very likely that the copper will become oxidised, and this oxidisation is the very worst foe we have to contend with in rendering our alloys ductile. I find the electro-gilding process before alluded to the best safeguard and the least troublesome in the end; as, in case of an alloy of gold in large quantities turning out brittle, we have, in this as well as in the other alloys, to resort to boracic and microcosmic salts, with repeated fusion, to remove the otherwise insoluble oxide; as in all alloying processes where these three metals are employed it appears to me that it is not the metal in the largest proportion which forms the base or body through which the lesser amount circulates, but that it is by the metal hardest in nature to fuse, forming a nucleus of particles, round which the less oxidisable metals disseminate themselves, cling to, and ultimately form an united mass with. This view of the subject may be nicely observed by placing a piece of copper, slightly coated with silver, on a charcoal support, and a piece of silver about its own weight, and a little powdered borax, then applying a blowpipe "reducing flame" to the metals, the silver soon becomes fused, and hangs like a globule of mercury about the lower surface of the copper; by increasing the heat as the copper approaches its fusing point, the silver will creep up its surface and be seen enveloping portion after portion of the copper and combining with its particles until nothing of the copper will be seen on the top of the button but a finely serrated edge of the metal, which will at last disappear in the mass. The manipulation with the blowpipe must be skilfully managed, or much of the beauty of the experiment will be lost, as when the silver is fused a "breathing flame" is sufficient to increase the heat to a degree that will fuse the copper: the slower the operation is performed the plainer its various phases may be noticed, and, to the lover of "metallic chemistry," it is a beautiful realisation of the Divine origin of the noble art to watch how even the metals rely upon their superiors for protection, as in combining them it is evident that, grade after grade they envelope and protect each other, (as in the instance of gold, silver, and copper in equal proportions, the compound is invul-

nerable, as is gold itself in some respects), but if a grain or two more of the inferior metals be added the protection is gone, the gold has a burthen more than it can bear, a greater amount of surface to cover than it can stretch its protecting influence over, and it becomes as easily assailable as though there were *no* gold there and all were dross.*

The 16-carat alloy was greatly used formerly for what is called filagree jewellery, i.e. the light gossamer or wire work in fashion some thirty years ago, and also for earrings, as its aptitude for coloring was a great inducement for employing it, as the work could be made very light; and still the color was produced so quickly that the work was not eaten through by the salts, though two or three applications of the color would destroy it altogether; hence my employment of the cupreous and reacting salts† to restore the color of faded or oxidised work without submitting it to the "destructive process;" my use of the sulphuric acid color‡ was adopted for the same reason; either the old process of wet coloring as before described or the sulphuric acid improvements will answer the purpose of producing a lasting fine gold color on the surface of this alloy, although at the expence of the article in the former instance, as the repetition of the old process invariably rots the work and renders it useless except as "old gold;" the articles made in the present day, though not a whit more durable, have still the same faults and a few others: but their time has not come yet, their doom, like the rest, will be the "melting pot." The solder usually employed is composed of:—

	oz.	dwt.	grs.
Gold 16 carats	0	1	0
Silver, fine	0	0	4
Brass	0	0	1
	0	1	5

This solder is used as described before for the other alloys, but this alloy of gold having much copper in it, it absorbs oxygen very quickly; so we are obliged to use a very thick borax solution to keep the surface clean during the heating operation.

I am sorry to say that there are members of the trade to whom some of my remarks upon the dishonesty of "the trade" have been very unpalatable. I look upon *their* censure as praise, and shall try to earn a little more of the reward. I may relate an instance of this uncleansed Augean stable. A gentleman, well known to *you*, (I enclose his name as a guarantee of good faith), purchased a set of what he considered "fine gold studs" of one of our seductive puffing retailers, who assured him on his word and "honor" that they were of the best material. What was the material? You shall see. In a week or two one of them was observed to be a little out of order; it was brought to me to repair; I told him that it was rubbish, and not worth repairing. "Why," said he, "I paid 21s. for the set a few weeks ago." I requested him to accompany me to my laboratory, and we would test it;* we then made a *destructive* analysis, and the result proved, what do you think? (it weighed 20 grains):—

Gold	4·5
Silver	1·0
Lead	76·0
Copper	6·5
Zinc and Tin	5·0
Organic matter and waste ..	7·0
	100·0

So you see there might originally have been nearly 1 grain of gold on the surface of the stud, the material of which its basis was composed being extremely thin layers of an alloy of gold, silver, copper and brass, struck up hollow, then filled with lead to give some degree of strength; but the most amusing part of the affair is this, that when the gentleman called to remonstrate, this *truly good* man at first denied that such a thing could be the case; but, when terrified a little, said there must be some mistake, and threw the blame on his *workman*,† called in his *porter* and abused him as such, and, finally, he wound up the affair by offering the gentleman a silver spoon for the difference, taking back the other two, for which he returned the money much against his will.

I have related this rather lengthy anecdote to give your readers an idea of how very necessary it is that they, as uninitiated men, should know something of these subjects when even a gentleman of such attainments as the person whose name I enclose should have been so imposed upon; indeed I may mention that it was upon his

* I merely mention these experiments as they occur to me at the time I am writing, as my business engagements might prevent me thinking of them hereafter.

† See *The Chemist*, No. VII.

‡ See *The Chemist* No. VI.

* The gentleman is a chemist of high repute himself.—ED.

† His workshop must be a large one if it extends from Dublin to Birmingham, where the studs were made.

recommendation that I published the first of these papers, and I have now the satisfaction of knowing that I have, already, done some service, as I have awakened some of the delinquents to a glimmering of conscience, a portion of their ephemeral being, of whose existence, I do not believe they were previously aware.

I will conclude by noticing for the nonce a letter or two I have received, expostulating with me upon what the writer in very figurative but very badly spelt English, terms, my "wholesale condemnation of a most useful class of mankind, i.e. the shopkeepers." I do not seek to condemn or even to hold up to ridicule any class or classes of mankind, so long as they keep their place and do or "say no more than is set down to them;" but when they usurp the position and talents of others for their own aggrandisement, and trade upon the brains of others, it is time to speak; they should remember that

"In the land of the north there are insects that prey
On the brains of the Elk to its very last sigh;
But Genius has foemen more cruel than they,
Who, first feed on his brains, and then leave him to die."

That labor, like all tasks imposed, has not only had devoted votaries, but also enthusiastic martyrs—men who live but to create, and, like the silkworm, perform what they deem their duty in this their narrow sphere, then vanish, too often the victims of an overwrought and ill-paid struggle for existence, consumed by a quenchless desire, their destiny is to work and die. I could, and perhaps will some day, tell all I have witnessed on this subject; but the memories of your readers will summon facts enough of their own experience to justify me in the course I have adopted; and when this great exhibition of manufactures takes place in your mighty city there will be facts elicited which will prove, no doubt, who works and who is paid; it may be then discovered that the capitalist is not the creator nor even the just purchaser of the means which made his name and enabled him to ride in his carriage to receive a prize for some piece of work which was perhaps conceived in a hovel or perfected in a debtor's goal. I need say no more; I need not mention JAMES MARSH, with whose name all your readers are acquainted, nor how he was requited, nor the inventor of the cotton-printing roller, men who made the fortunes of hundreds, but who died in poverty themselves, having given their own genius for the benefit of future generations. But I hope to see some change in this respect, when the ill-paid operative (let him be professional, mechanical, or useful in any way more than ordinary) will stand some chance of his meed of praise.

Craving *your* indulgence for this long insertion, and your readers' for the trial I have inflicted on their patience,

I am, dear sirs, truly yours,

WILLIAM GRIFFITHS.

Dublin, April 1st, 1850.

*** We are much obliged to our highly esteemed contributor for his very useful practical papers, and we sincerely hope that his manly and honorable exposure of the abominable frauds practiced in the manufacture of articles of gold and silver will be attended with that benefit to the public and the honest manufacturer which should result from it. We know Mr. Griffiths to be an exceedingly clever, scientific, practical man, and, moreover, one whose integrity and veracity may be depended upon.

We should be very glad to see the example of Mr. Griffiths followed by some of our intelligent readers as regards other manufactures.

ON THE USE OF PYRO-GALLIC ACID IN PHOTOGRAPHY.

BY J. S. ARCHER, ESQ.

THE proposed employment of a layer of albumen on glass as a substitute for paper having given a new impulse to the photographic art, tending to produce a surface which bids fair to rival the daguerreotype plate in the delicacy of its delineation and in the sensibility of its surface, induces me to call the attention of those engaged in photographic pursuits to the use of pyro-galllic acid to develope the latent picture.

Although gallic acid in combination with the ioduret of silver produces a very sensitive surface, it is, in this respect, far surpassed by pyro-gallic acid.

During the last summer I used this acid with considerable success, its action being both rapid and sure.

The proportions I took were as follows:

40 grains nitrate silver dissolved in about the same quantity of water, to which is added
1 oz. of glacial acetic acid
4 grains of pyro-gallic acid dissolved in 1 oz. of acetic acid.

Equal parts of the above solutions are mixed, applied to the iodized paper and at once exposed to the action of light.

The length of the exposure and the time necessary to develope the picture of course depend upon the power of the light at the time; these are points however which a little experience will soon decide.

There is one advantage in the above preparations, that no second wash is necessary to bring out the picture.

I may also remark, that the more acetic acid and the less water, are used, the better, in the preparation of the nitrate of silver and pyro-gallic acid solutions for producing the sensitive surface; for this acid seems to have the power of, in a great measure, preventing spontaneous change.

I need not say that a surface so sensitive as this will not keep.

If on mixing the acetic acid with the nitrate of silver any acetate of silver should be formed, a small quantity of water must be added to dissolve the same.

Care must be taken that the pyro-gallic acid is quite pure, otherwise the light of the picture will be discolored.

The acetic acid also should be quite pure.

EXPERIMENTS ON THE MANUFACTURE OF BEET ROOT SUGAR.*

BY M. FRED. KUHLMAN.

In two notes published in 1838 and 1838, I pointed out the advantages which would accrue to the manufacturer of sugar from the use of lime in the defecation and the employment of a current of carbonic acid to displace the chalk combined with the sugar. A large establishment at Magdeburg has for seven years profitably used the process of which I strove to show the utility; and more lately, apparatus for injecting carbonic acid into the beet root juice charged with lime has been erected in several of our sugar houses in the north of France. In consequence of this and at the request of several sugar makers I have united my previous publications into one short treatise, and in presenting some copies of the new work to the Academy I beg to call its attention to the results of some recent experiments of which the knowledge appears to me of some interest to the sugar manufacture.

In order to fix within what limits as to quantity the use of lime as a defecator should be confined, I made some experiments to determine what amount of this alkali combines with the sugar, during the manufacture, and likewise, how much remains in the beet root juice after the use of carbonic acid.

In a first experiment made on beet root juice defecated in making with 2 per cent. of lime, without bringing the heat to the boiling point, I have determined by analysis that the amount of lime dissolved never exceeded 176 grammes in a hectolitre (hundred quarts.) In the same juice, alkalimetrical experiments showed a quantity of various alkalis representing 205 grammes of lime. There was likewise in this juice, in the state of potassa or soda, an amount equal to 29 grammes of lime. Treatment with carbonic acid left in this juice, in various alkalis equal to 60 grammes of lime;* whence it results that carbonic acid removed only 145 grammes of lime out of 176, and that 31 grammes of lime remained dissolved independent of the free potassa and soda, of which we have already fixed the proportion.

In another experiment with 1½ per cent. of lime for defecation and carried to the boiling point, the quantity of lime, as ascertained by alkalimetrical tests, was 228 grammes the hectolitre, and after the action of carbonic acid there remained of lime or its equivalents of potassa or soda 80 grammes: a second treatment with carbonic acid again removed 46 grammes of lime.

If the amount of lime dissolved in the juice varies, the carbonic acid will restore it to the above-mentioned proportions if furnished in sufficient abundance.

It will be understood that it would be useless to employ too much lime, as an increase of temperature will, within certain limits, remove the necessity for an augmentation of the quantity of alkali. In all cases 1½ per cent. of lime appears to me to be sufficient. This would however be learnt by a sufficiently long experience in the manufacture.

There is one important fact which I cannot pass over in silence. I have said that the presence of lime in the solution of sugar was an essential condition of its stability and good preservation. To the facts already mentioned I will add the following observation:

Some juice defecated with an excess of lime, enclosed for a month in a closed

* *Comptes Rendus, No.* 12, March, 1850.

* Ten quarts give 21 degrees with the alkalimetrical liquid weakened by water to a tenth. Ten quarts then saturate 0·105 of hydrated sulphuric acid, which represents 60 grammes of lime in the hundred quarts.

bottle, preserved its color, clearness, characteristic odor and alkalinity; no sign of alteration was perceptible: some of the same beet root juice, after the separation of the lime with carbonic acid, put into a bottle and kept in precisely the same circumstances, underwent a great alteration in the space of a month; the juice became brown in color, lost its transparency, and had an acid, tainted odor; it had fermented. This demonstrates the preserving property of lime, and the necessity of concentrating, without delay, the beet root juice after the treatment with carbonic acid.

All our manufacturers are aware that the alkalinity of beet root juice, after defecation, does not depend exclusively on the lime, and that an appreciable quantity of potassa and soda augments this alkalinity which carbonic acid cannot destroy. They likewise know that these free alkalis react in a very troublesome manner in the various operations when the liquids are very concentrated, and submitted to the highest temperature. The solution of the problem of the displacement of these alkalis would be a great point in the sugar manufacture. Unfortunately, this displacement is not easy, for, if we do know some expensive reagents they are only suited for the delicate operations of analysis. To arrive at a useful result on this point, I applied all my efforts to place potassa and soda in such a state of combination that they should have little or no action on the sugar.

The first method that presents itself to the mind, is the saturation of these alkalis by an acid, or an acid salt, as has often been proposed for the saturation of the lime after the defecation; but as it is difficult to ascertain the exact amount of acid sufficiently exactly, and as, besides the quantities of potassa and soda are inconsiderable, it will often happen that in this way, manufacturers will be exposed to an alteration of the sugar by an acid in endeavoring to avoid alteration by an alkali. In fact the acids and acid salts do not possess, like carbonic acid, the valuable advantage of being capable of employment in excess, without injuring the quality of the sugar.

I at one moment hoped to arrive at better and secure results, by the use of sulphate of magnesia, a neutral salt, an excess of which could do no sensible harm; but it happened that the magnesia was not precipitated in the presence of the potassa and soda, the reaction being modified by the sugar.

My last attempts have given more satisfactory results. If, as we have just stated, the reciprocal decomposition of the salts with an earthy base, and carbonates of potassa or soda, or of these alkalis in the caustic state, does not take place in the presence of sugar, I thought that these inconveniences would not exist if, instead of trying to saturate the potassa or soda in the displacement of an insoluble salt or base we tried to produce this saturation by using a salt the base of which could be displaced in the state of an elastic fluid. It was in consequence of these reflections that I was led to base the saturation of the potassa and soda of alkaline sugars on the decomposition of ammoniacal salts.

Into some beet root juice defecated with an excess of lime, then purified from lime with carbonic acid before concentration, was put, in one experiment sulphate, and in another, muriate of ammonia, in the proportion of 1 per cent. for the sugar contained in the juice, that is to say, about 1 per cent. of the quantity of juice. In both experiments a great quantity of the potassa and soda were saturated by the acid of the ammoniacal salt, because the disengagement of ammonia was very considerable. But, towards the end of the evaporations, the saccharine liquid suffered a slight acid reaction; the excess of the ammoniacal salt may, thus, become injurious. The sulphate of ammonia produced another inconvenience, the slow precipitation of some sulphate of lime proving that the lime remained combined with the sugar. The best results were obtained by employing phosphate of ammonia, 1 per cent. of this salt having been added to the beet root juice, after defecation and treating with carbonic acid, the lime still retained in the liquid was displaced instantly, and the liquid was visibly paler colored. The concentration and boiling were most easy; the liquid had a very slight acidity at the end. The boiled sugar was very light colored, there was an abundant crystallisation; and, which was not found in any of the other experiments, the sugar as well as the molasses might be compared to cane sugar in taste; the disagreeable flavor of the beet root had quite disappeared.

This laboratory result having been repeated several times with the same success, I was tempted to make a manufacturing attempt on 12 hectolitres of juice; the defecation was performed with 1½ per cent. of lime; the carbonic acid was produced by the combustion of charcoal; the ammoniacal salt, in the proportion of 1 kilogramme for the 1200 litres was added after the carbonic acid had produced its effect: the precipitate of phosphate of lime became confounded with the precipitate of carbonate

so that the filtrations were not complicated. The juice thus treated was first filtered in a small Dumont's filter, charged with animal charcoal and filtered again in the same manner when evaporated to 22 degrees. The boiling was most easy; the juice preserved a very slight alkalinity, which proved that the proportion of the ammoniacal salt had been correct. The sugar obtained was of a very superior quality, especially remarkable for its fine flavor. A quantity of 12 hectolitres of beet root juice was treated in the same manner as far as the defecation and the displacement of lime by carbonic acid, but did not receive the addition of the ammoniacal salt: the result of the boiling was less beautiful, the syrup was very alkaline and had a strong flavor of the beet root. It was far inferior to the sugar of the ammoniacal salt experiment both as to quantity and quality.

I cannot too strongly direct the attention of manufacturers to the results of these last experiments, as I here find a correct solution of the problem of concentrating the syrupy liquid, and boiling it without the quality of the sugar being injured by the presence of potassa, soda or their carbonates.

I have pointed out a proportion which gave me good results, and which, in continued working, would give still better. Without doubt these proportions would vary according as the sugar contains more potasa or soda; but it will always be easy to ascertain the correct quantity of ammoniacal salt necessary by alkalimetrically testing the beet root juice after the displacement by carbonic acid. Having determined the quantity of sulphuric acid necessary to saturate a litre of the juice, it is easy to establish the proper weight of ammoniacal salt to employ. It will suffice for this purpose to take 1 equivalent of ammonia in the salt for 1 equivalent of the sulphuric acid determined by the test.

The phosphate of ammonia presents the double advantage of displacing the excess of lime retained by the sugar, and of saturating the potassa and soda. When the manufacture of phosphate of ammonia is arranged on a large scale, this product may be brought into the market at a sufficiently moderate price to be used in the sugar houses. Besides the proportion of free alkali in the sugar being well determined, phosphate of ammonia may be replaced, at least in part, by the acid phosphate of lime: it is important that the ammoniacal salt should complete the saturation, and that the quantity added of the saline mixture should be rather within the limits indicated by the alkalimetrical test than that it should exceed them.

ABSTRACTS OF SPECIFICATIONS OF CHEMICAL PATENTS RECENTLY ENROLLED.*

Improvements in the Manufacture of Starch, and other like articles of Commerce, from Farinaceous and Leguminous substances. H. ATTWOOD and J. RENTON. Sealed Sep. 13, 1840.

OUR improvements consist in effecting the separation of starch from the other substances with which it is combined in farinaceous and leguminous substances, by a more expeditious process, and by the use of cheaper agents than those commonly employed. And in order that these improvements may be clearly understood, we shall by way of exemplification describe the mode in which we manufacture starch from rice, and point out those parts of the process which we claim as being new and of our invention.

We take whole or broken grains of rice, with or without the husk, or rice flour, and throw them or the flour into a shallow or other convenient vessel. We then pour in a solution of lime and chloride of sodium (common salt), sufficient to cover the whole of the rice, that is to say, about 26 gallons of the solution to about 112 lbs. of the rice. We make this solution by mixing slaked lime and chloride of sodium and water in the proportion of about 100 lbs. of lime and 30 lbs. of chloride of sodium to 500 gallons of water, or in any other like proportional quantities. But we do not confine ourselves to the above proportions, as other proportions might be used, though with less advantage. The solution thus made is to be allowed to settle and the clear top liquor only drawn off for use. We let the rice remain thus submerged for about six hours, stirring it well every half hour. We then draw off the liquid by means of suitable taps, and cover the rice with a fresh quantity of a similar solution; the rice is again exposed for six hours to the action of the solution, being well stirred once every half hour as before; after which the liquid is to be drawn off, when the rice is ready to be ground.

The grinding is effected in the usual way, and the ground rice transferred to what is called a "rousing vessel," and covered over with a quantity of a solution similar to that before mentioned. The ground rice is then to be well stirred or roused for about 2 or 3 hours. From this vessel the rice is removed to a separating vessel or vessels, in which it is left to stand for about six hours, in order that the starch may be separated from

*Collected from *The Mechanics' Magazine*.

the gluten with which it is combined. To save time we generally perform the stirring or rousing process the last thing at night, so that the separation may be effected before morning. On examining the separating vessel or vessels, a thick or creamy matter is found deposited at the bottom, which is the starch mixed with a portion of fibrine, while the gluten floats near the top of the liquor. We then draw off the liquor as close as may be to the creamy deposit, and fill up again with cold water, which after a little time is also drawn off.

The starch or starchy matter is now to be separated from the fibrine with which it is intermixed in the usual way adopted by rice starch makers. For the purpose of facilitating the separation of the starch from the fibrine in the water, we sometimes use a sliding or telescopic tube placed vertically over an outlet at or near to the bottom of the vessel, and in such a manner that the upper end of the tube can be gradually, and from time to time depressed, until the whole of the starch floating in the water has been run off from the fibrine which falls towards the bottom. The moist starch is run into a receiving or filtering vessel, made with a false bottom, or side, consisting of one or two, or more plates of perforated zinc or woven wire, or other suitable material, with an intermediate sheet of cotton, linen, or some such fabric, the whole being carefully fastened, so that none of the starchy matter may escape. From between the bottom or side of the vessel and the perforated zinc plate or plates, or other suitable material, there is a pipe which leads to an exhaust pump.

On the starchy matter being run off into the receiving or filtering vessel, the pump is set to work, when it draws off all or most of the excess of water with which the starch is charged, but brings off also along with the water a portion of starch which the meshes of the false bottom or filter have failed to intercept. The pump therefore is made to empty itself into a long shallow trough, or a series of shallow troughs communicating with each other, so that the starchy water may have to run a long distance before it is finally allowed to run to waste, and so as during its progress to deposit the whole of the remaining starch. For this purpose the trough or series of troughs should be placed so as to cause a continuous, but very gentle flow of the water, say at an inclination of about 1 inch in 100 feet. The width of the trough or troughs should be in proportion to the quantity of water holding the starch in suspension, and it will be better if the depth does not exceed 4 inches. We have found in practice that in a run of about 300 feet the water will come off perfectly clear and free from starch.

The whole of the starch which has been thus separated and collected is now ready for what is called "boxing," after which it is to be dried in the usual manner. The gain so far, by the means and methods we have described, that is to say, by the use of the lime and salt solution and processes aforesaid, is such that we can advance the manufacture of starch in about 48 hours to the same stage which it now takes about one hundred and thirty-two hours and upwards to arrive at, and obtain besides an increase of from 6 to 7 per cent. in the quantity of starch produced.

The starch is, we believe, also much purer than any obtained by means of a caustic alkaline or acid solution, and fitted for all purposes to which wheaten starch produced by fermentation is usually applied. We prefer using the solution of lime and salt cold, because more lime can be dissolved in cold than in hot or warm water, and because also the risk of fermentation is thereby diminished; but we do not confine ourselves to the use of the said solution at any particular temperature. Starch of a good quality for some purposes, though not for all, may also be made by using solutions of lime alone in the manner before specified; in which case, however, we make the solution of lime with cold water, and use it in that state only, and confine our claim to the use of it in that state. The same lime and salt solution as aforesaid may also be employed with the like good effect in manufacturing starch from rye, peas, beans, and other leguminous substances, and in the preparatory steps also of the manufacture of other like articles of commerce, such as dextrine or British gum.

Improvements in Electric and Galvanic Instruments and Apparatus and in their application to Lighting and Motive purposes. W. E. STAITE and W. PETRIE. Sealed Sep. 20, 1849.

CLAIMS.—1. We claim the hydro-barometers described, and the employment of them in the cells of galvanic apparatus so that the fresh liquid supplied has to pass through them, whereby the relative degree of exhaustion of the liquid in the cells is indicated to the eye at any moment by the difference of level between the liquids interior and exterior to the tube.

2. The inclosing porous materials, such

as may be used for ordinary capillary syphons for the liquids of galvanic batteries, in flexible waterproof tubes (vulcanized caoutchouc being the material preferred) as described, and the use of a clamp or plug to act on the sides or orifice of the waterproof envelope of the syphon, so as to regulate the discharge of the liquid.

3. The process of covering articles used for galvanic batteries, or in connection with them, with a coating of sulphur, as described.

4. The improved gravitation supply apparatus described; that is to say—the use of a closed reservoir, placed below the battery, connected with the cells of the battery by tubes in such a manner that the exhausted liquid, which becomes dense by being used, shall flow down one tube and rest in the lower part of the reservoir or cask, while the hydraulic pressure of this denser liquid in the said tube shall drive a supply of the fresh liquid from the reservoir up the other tube into the cells.

5. The "negative supply apparatus" by gravitation, described; that is to say—the use of a tray or shallow reservoir to hold a supply of such liquid or solution as becomes specifically lighter by being used in the battery, in combination with syphons connecting it with the battery—one syphon leading from the lower part of the liquid in the tray to the lower part of the similar liquid in the galvanic cell, while the other syphon leads from near the surface of the liquid in the cell to near the surface of that in the tray. And also the use of a colander or porous support in the said tray, to hold matters to be dissolved in the liquid that is used when the liquid is of such sort as to render that desirable. And also the application of sulphur to the interior of galvanic batteries, to render the joinings water-tight and acid proof.

6. The self-clearing capillary-tube syphon described; that is to say—the use of syphons composed of capillary tubes, which have a conical or trumpet mouth at their lower ends where the liquid is discharged, whereby they clear themselves of any air bubbles that may enter the tube.

7. The use, in double-fluid galvanic batteries (in lieu of dilute acid), of a saline solution next the positive plate of a galvanic cell, in combination with a different solution next the negative plate of the same cell, with a porous diaphragm between them, as explained.

8. With regard to the improved concentric cell described—first, the employment of a hole or bore from the top part of the negative element to its lower part, and channels cut in the said element horizontally from the aperture of the said bore at its lower end to different parts of the sides of the element; secondly, the use of the negative element of a polygonal section, or grooved vertically, so that while it fits as close as may be to the sides of the porous cell, there shall remain vertical passages between the two surfaces for the liquid to pass upwards at every part of the horizontal section of the negative surface; thirdly, the reduction of the horizontal section of the negative element from a little below the surface of the liquid in the cell upwards, so as to leave a freer space for the subsidence of bubbles, and to prevent the motion of the negative element from splashing the liquid over; and fourthly, the use of a band or strap of metal (copper being preferred) drawn tight around the top part of the negative element by means of a screw, so as to obtain firm contact at many points between the negative element and the strap, for the purpose of conducting the electric power.

9. The improved arrangement or construction of galvanic battery, where a large number of cells are to be employed, as described.

10. The inclosing of such galvanic batteries as emit vapors or gases within a case which has a cover or lid that is made air-tight by means of a water lute, as described. (In the channel into which the edges of the lid fits, various solutions may be used in place of simple water to neutralize the nature of the gases evolved; thus, for the nitric-acid batteries a solution of lime may be used. Plates of glass may also be set into the cover, whereby the condition of the batteries may be examined.) We also claim the use of the air-tight arrangements for supplying and drawing off the liquids of such batteries; namely, the introduction of tubes for such purposes through sheets of vulcanised caoutchouc stretched tight, or secured without tension over holes in the case or cover of the battery; the holes in the caoutchouc being cut smaller than the tubes which are to pass through them, make a very air-tight but flexible joint. Also we claim for the same purpose the use of a hydraulic trap in any tube or trough used for supplying or discharging liquids to or from such batteries, as described.

11. In regard to the treatment of iridium, and of the manufacture of articles in that metal, for the purpose of our invention: First, the formation of a bed from the powder or grains of the iridium itself on which to fuse the iridium by the passage of the disruptive discharge of electricity. Secondly, the use of a solid piece of iridium

itself as the opposite electrode in the process of fusion, as described. And, thirdly, the process of working a solid piece of iridium into more perfect shape by connecting one part of it with one wire of the battery (the positive), and working upon it by the disruptive discharge to the positive iridium electrode, as has been more particularly explained.

12. In regard to the equaliser described: First, the use of a platinum wire of sufficient thinness, so arranged as to be immersible, more or less, in mercury, while the part out of the mercury is covered with water (certain other imperfectly conducting liquids, or liquid solutions, may be used instead of water, as alcohol or dilute sulphuric acid), so that the electric current, to be equalized thereby, being passed through the mercury, and the part of the wire that is above the surface of the mercury is thereby resisted and diminished more or less, according to the length of wire remaining above the mercury, which wire may be moved when required (by the human hand for instance) for the purpose of regulating, or increasing, or diminishing, the electric current. Secondly, the combination of the above apparatus with an electric regulator, such as described, so that the motion of the regulator shall make the wire to rise or fall in the mercury, and thus check and prevent any material variation in the quantity of the electric current circulating in the conductors with which this instrument is connected. Thirdly, the application of self-acting rheostats to branch currents diverging from and rejoining a main conducting circuit, so that several lights can be maintained or operations performed by current electricity from one battery or main circuit without the risk of variation or accident from one affecting the action of the others. And, fourthly, we claim the substitution of a number of fine springs (platinum wire being the material preferred) to make contact with the moveable helix of fine platinum wire, in place of mercury, as a means of contact in the "equalizer."

13. The compensating dial-balance galvanometer described; that is to say, we do not claim the application of an electric coil with an iron rod moving in its centre, for the purposes of galvanometry; but we claim, the combination of the coil and iron centre, with the pinion working into the rack affixed to the iron centre, so as to indicate the motion of the iron centre by the rotation of the pinion or its connexions, for the purpose of measuring the power of the electric current. Also, the application of a partial counterpoise-weight, on a wheel or arm fixed to the spindle of the said pinion, the weight being of such amount and applied in a line with such part of the circumference of the pinion as shall have the most effect in making the spindle of the pinion to pass through more equal arcs than otherwise, when equal additions are made to the power of the electric current actually passing in circuit. Also, the application of the triode or appendage, by which a free electrically conducting connection can be made or broken at pleasure, between the conductors (such as the screw clamps) connected with the two ends of the conducting wire which is in the galvanometer. The object of the triode being to make a freer passage for the current than the galvanometer wire itself affords, when the galvanometer is not required to give its normal indications. We further claim the triode in its combination with quantity galvanometers, that is, with such galvanometers as give a palpable indication of the change, when any resistance is added to or taken from the circuit of such electric currents as they are fitted to measure. And, finally, the combination of the triode with any intensity-galvanometer (that is, a galvanometer which gives a palpable indication of the change when the electro-motive force of the current is increased or diminished) that may be preferred for use.

14. The differential galvanometer described, that is to say, the use of one or more lengths of insulated wire, in connection with otherwise, so arranged in connection with the coil of a quantity-galvanometer, that the coil, or the wire can be included in the circuit to measure; circuit completed without it, at pleasure for as, for instance by turning set screws for the purpose of obtaining an indication of the intensity (or electromotive force) of the current, by observing the quantitative indication of the galvanometer, with and without the said wire being included in the current. We also claim the arrangement of wire when used to form a partial resistance to an electric current in a coil, having the reversed windings, or having the flat form as hereinbefore described, for the purpose of neutralizing the electromagnetic effects of the current in the said coil.

15. In respect of the improved lamp movement described, First, the use of a screwed and slotted electrode shaft, with a wheel screwed on it, the whole being so arranged that the revolution of the wheel shall cause a longitudinal motion of the shaft. Secondly, the use of a spring support for the said wheel, or for the support of the shaft, whereby the wheel

sinks a little when the electrodes are brought tightly into contact, and in sinking its teeth shall meet a stop to arrest its further motion, so as to prevent too great a pressure on the electrodes, as explained. Thirdly, the combination of an elastic head, with the moving centre of the regulator; and, Fourthly, the use of a chain and barrel, in place of a rack and pinion, for supporting and imparting motion to the electrode shaft, in certain electric lamps, as has been fully explained, with the special advantages attending it.

Improvements in the Manufacture of Manure. I. M. BLASHFIELD. Sealed Sep. 27, 1849.

THIS invention consists in the conversion of river mud into manure by the following process:—The upper crust of mud is collected as being the richest, and removed to a suitable building, where it is mixed with sulphate of lime to prevent the escape of ammonia, spread upon a floor heated by flues, and dried to the consistency of clay. It is then treated, in a close chamber, with one-fourth of its weight of sulphuric acid, and moistened with water; after which it is dried and mixed with other materials in the following proportion:—

1100 cwt. of saturated mud.
400 ,, superphosphate of lime.
300 ,, sulphate of ammonia.
100 ,, sulphate of soda.
100 ,, sulphate of potassa.

CLAIMS.—1. The manufacture of manures from mud by subjecting it to artificial heat, and treating it with acid.

2. Combining the materials before mentioned, or any of them, with mud, when heated and treated with an acid as described.

Improvements in certain materials to be used in the process of dyeing and printing. JOHN MERCER, Oakenshaw, Lancashire, and WILLIAM BLYTHE, Holland Bank. Sealed April 15th, 1850.

The invention claimed in the specification of this patent is the formation of concrete solid double salts of oxide of tin, or stannic acid, with phosphoric, arsenic, or arsenious acids, in combination with soda, potassa, or ammonia; and the employment of either of the double salts so formed in the process of dyeing and printing cottons, mousseline-de-laines, and other fabrics, in the place of stannate of soda. These double salts are termed, according to their composition, arsenio-stannate of soda, stanno-phosphate of soda, etc. Either of these double salts, formed as above mentioned, will answer the required purposes, but the patentees give the preference to the employment of arsenio-stannate of soda.

Their mode of preparing this arsenio-stannate of soda is, by adding arseniate of soda (formed by fluxing together arsenic acid and nitrate of soda) to stannate of soda, in such proprotions as shall be found to be best adapted for making a concrete solid double salt, and the patentees state that they find the use of equivalents of stannic and arsenic acids to be the best proportion. For this purpose they take one gallon of stannate of soda liquor, of the strength of 50 degrees of Twaddle's hydrometer, and to it (placed in an iron pot over the fire) they add one pound and a half of arseniate of soda; they take from time to time some of the thin fluid out of the iron pot, and place it on a plate or stone to cool, and when it readily concretes into a solid mass the operation is completed, and the arsenio-stannate of soda is finished. This is dissolved in water for use, and employed in the same manner as stannate of soda is now used. If stanno-phosphate of soda be preferred, the patentees direct its preparation to be made by adding phosphate of soda to stannate of soda.

The patentees do not claim any particular method of preparing the arseniate of soda, or phosphate of soda, etc, but state that the ordinary methods of preparing these salts will suffice; but they claim:—

The exclusive manner of manufacture, and use of, concrete solid double salts, formed of oxide of tin or stannic acid, with phosphoric, arsenic or arsenious acids, in combination with soda, potassa or ammonia, for the purpose of dyeing or printing cottons, mousseline-de-laines, and other fabrics.

III. PHARMACY, MATERIAMEDICA, THERAPEUTICS, &c.

TO THE MEMBERS OF THE PHARMACEUTICAL SOCIETY.

GENTLEMEN—As it is impossible to obtain an impartial hearing at the Pharmaceutical Society, or the insertion of an adverse article in the Pharmaceutical Journal—a journal *professedly* devoted to your interests—I am compelled to adopt this medium of addressing you on subjects which most seriously affect your professional advancement, and your not less important pecuniary welfare. Most unaccountable it is, that you should supinely witness the growth and prosperity of that hydra-headed monster, that family and sectarian clique of Pharmaceutical officials, bound together by a common interest, which rules and dogmatises over not only the Society itself, but over even the majority of the Council, when by your voice and your vote you could teach this audacious clique, that the Society was established for the benefit of the many, and not for the emolument of a covetous few. The connection of the Pharmaceutical Society with Bell's Journal is an absurdity and an iniquity unparalleled in the history of journalism and of corporate bodies. Those societies which publish a journal or transactions, do so in their corporate capacity. The credit and the profit arising from the sale thereof accrue to no individual member, but to the Society itself: no man's name is heralded forth as its editor. But not so with the Pharmaceutical Journal. The name of Jacob Bell is emblazoned from the pages of "Punch" to the columns of the "Patriot." He truly boasts monthly that his Journal has the largest sale of any scientific periodical: the public, little dreaming by what machinations this preeminence is accomplished, believe the voice of Jacob to be oracular, and his successful feat in journalism to be the well-earned reward of scientific and literary ability, not of time-serving policy, or of base truculence to those who only tolerate the existence of his Journal by being allowed to pursue their own dirty work unmolested. Little do the public imagine that we, the members, are silly enough to supply the sinews in the shape of subscriptions, to the Society that enables this jack-in-the-box to throw his head about and brag of his prosperity.

But here do not end the consequences of our suicidal folly. The public and the medical profession, in the sacredness of their simplicity, believe that the shop of this mock high-priest of Pharmacy is, and must be, the best emporium for drugs, and for the preparation of prescriptions. The physicians recommend, and the public pay for, this delusion to our cost and injury. Well may the voice of Jacob cry "Union is strength." "Let us keep the demon of discord out of our Society, for our very existence depends on mutual support and a good understanding." Truly, the existence of his Journal, and the continued increase of his business, and of the businesses of his clique, who are sworn to mutual support, depend upon our mouths being gagged with their flummery. How many hundreds of the members are finding their businesses decrease annually more or less, or at least not increase, according to their expectations, merits, and exertions, in spite of improved pharmaceutical education, and the so-called fostering influence of the Society and the Journal. Who gains by their loss? Jacob and his parasites.

Jacob writes the history of Water Companies in his Journal, defends their infamous monopoly, and forwards copies of his history gratis to those who are interested in upholding this traffic. What is his reward? Prescriptions! Jacob denounces a new Gas Company. Copies of his denunciation of course go gratis to the monopolists. The reward—Prescriptions, more prescriptions!! Jacob exposes Life Assurance Companies who refuse to fee the medical referee The doctors pour in prescriptions, more prescriptions!!! Jacob reviews, as he terms it, Dr. Blunderhead Brown's work on "Qualms of Conscience;" declares it to be a work displaying vast research and profound erudition, and ought to be in the hands of every family. Dr. B. B. shows his gratitude by sending prescriptions; more prescriptions!!!!

Jacob rejoices in having a tried friend, a disinterested manufacturer of morphia who finds he cannot compete with others in the price thereof. He obtains some of the rival article, adulterated of course, he thinks. Rubbing his hands with delight, he finds salicine in it. Jacob in becoming language announces the fact. In a little while, it is

not salicine but sugar which he detects. Jacob is again triumphant in the analytical skill and honesty of his friend. Encouraged by this success, his friend makes a second campaign, but in this instance backed by the skill and appliances of the Pharmaceutical Laboratory. He will not condescend to say what he found, or how he found the adulteration; sufficient for him to assert that the morphias were adulterated These clever tactics threw the sale of the morphia back into the old channel. It is scarcely necessary to observe that a few malignant individuals even now doubt whether the morphia was adulterated in either instance.

By Jacob's dexterity the Pharmaceutical Journal is read *gratis* by all classes of Her Majesty's subjects, except unfortunate chemists. To enable Mr. Bell to carry on this glorious game, you assist in every possible way. You employ the Council of the Society to purchase his journal for you, as though you were incapable of laying out your own money to advantage or with discretion.

When you possess it, you never read it; not because there is nothing interesting in it, oh no! but because you believe, in your modesty, that you are too stupid to comprehend or appreciate its excellence. You never will believe that a man can edite a journal without brains; therefore, when one of the clique proposes a vote of thanks for his brilliant editorial labors, at a pharmaceutical meeting, you help it to be carried with acclamation.

How long this humiliating spectacle is to continue, I leave to the energy of those who are ready and willing to strike the first blow.

I am gentlemen,

Your obedient servant,

E. M. L.

A NEW METHOD OF PREVENTING THE LOSS OF WATER BY EVAPORATION IN TANKS, RESERVOIRS, PONDS, WATERHOLES, &c., AND ESPECIALLY ADAPTED FOR USE IN HOT CLIMATES.*

BY ROBERT J. GRAVES, M.D., M.R.I.A.

In certain regions of the earth nature has placed obstacles, apparently insurmountable, to the free and comfortable enjoyment of existence; one of these has hitherto baffled all the efforts of art, and is caused by the prevalence of drought: thus, in Australia, rain falls at certain periods of the year in such great abundance, that the rivers overflow their banks, and large tracts of country are entirely inundated for a considerable length of time; shortly after the close of the rainy season the water subsides; and in the course of a few weeks, so great has been the evaporation, that where deep and rapidly-flowing rivers existed, nothing remains but stagnant pools, water holes, and lake-like reaches of the river, occurring at intervals in their former beds: these natural reservoirs of water are of the most vital importance to the colonists and their extensive flocks. But there are many seasons, during which the air becomes so extremely hot and dry, that even these reservoirs are dried up, and man and beast are forced to quit the now inhospitable district. A similar defect of climate exists in many other countries, such as Hindostan, Scinde, and those kingdoms bordering on the banks of the Euphrates, which were the very first settled and occupied by civilized peoples. Man has in all these places struggled from the earliest periods to secure for himself a sufficient and continuous supply of water—the life-blood of living beings, whether animal or vegetable. To promote an object of such paramount importance, we find that national works of the most expensive and magnificent description have been undertaken by the rulers of these countries: thus, in Hindostan, the Mogul Emperors have each emulated his predecessor in the construction of tanks of immense magnitude, and at enormous expense, to preserve the necessary supplies of water during the dry season. The Kings of Ceylon even exceeded the Mogul Emperors in the size of their tanks, constructed for the same purpose, while in Mesopotamia, and the countries watered by the Tigris and Euphrates, as likewise in Persia and Affghanistan, the inhabitants resorted to the expedient of constructing reservoirs under ground, and in some instances they even went so far as to conduct rivers league after league beneath the soil, in order to obviate the evil results of evaporation: each village having a well, by means of which they were enabled to draw up the treasures of these subterraneous currents. In Constantinople the Greek Emperors built extensive arched reservoirs for holding water, and from which a considerable portion of the city was supplied with this indispensable element.

* Communicated to the Royal Irish Academy, on Monday, Feb. 12, 1850.

To persons living in this moist climate it may appear of very little importance to guard against the evaporation of water and the effects arising from it; but to the philosopher, who, by experiment in his laboratory, has made himself familiar with the power of evaporation; or the traveller, who, like Mr. Sturt, has seen in Australia evaporation carrying off daily from reservoirs the water upon which his own life, and that of his companions and cattle, depended; and who has marked the appalling rapidity with which it disappears, when the air has become dry or parched from the great heat prevailing; to such, I say, it must appear evident that evaporation may become so intense as to render nugatory all efforts to preserve any large supply of water in open tanks or reservoirs, and thus prevent the colonization of countries in other respects most desirable. Sir T. L. Mitchell observed the thermometer at 126° in the shade, under the influence of the hot dry wind of Australia. How rapidly must evaporation proceed, when water is exposed to such a wind?

It is my object to show that this great source of waste may be effectually prevented, and that, too, by very simple means; and that the surface of reservoirs, tanks, water-holes, and ponds, in the hottest climate and warmest weather, can be for the most part preserved from the loss occasioned by evaporation.

The method which I propose for resisting the evaporation of water could not have been either thought of or applied before the present time, when a succession of discoveries has rendered us masters of many vegetable substances, such as Indian rubber, gutta percha, &c., which, after passing through certain simple processes, may be made available for rendering linen, cotton, woollen cloths and canvas, when even of the finest texture, impervious either to air or water. It is by the help of such prepared canvas that the contrivance I am about to describe is to be carried into execution.

Those who are practically versed in this department of art will readily suggest what species of impermeable water-proof canvas is best adapted in practice for the accomplishment of so desirable an end. For me it is sufficient to know that such a material can be manufactured at a cheap rate, of a light but strong texture, and in sufficient quantities to cover, as with a carpet, any extent of water that may be necessary. Where a piece of water is to be protected from evaporation, its water-proof carpet may be spread by the following simple means:—at suitable distances from each other on the canvas, and made of the same material, are to be inserted, pouches or bags, which, when it is wished to float the canvas on the water, may be inflated with air in the usual manner; when not in use these bags need not, of course, be otherwise than in their collapsed condition. Let us suppose a piece of canvass nine feet in breadth, and 150 in length, having three bags in rows, twelve or fifteen feet distant from each other; let us suppose such a piece of canvas placed on the water of a tank, it will then protect from evaporation a surface corresponding to its own extent. Similar pieces might be attached, by tying together their sides and ends, until the whole surface was similarly protected; all this could be done without much labor or trouble; the canvas could be carried in a boat, and dropped from its stern in the same manner as fisherman drop their nets, the men inflating each row of pouches or bags at the time it became necessary to cast them in; ropes could be also fastened to the extremities of the piece, so as to connect it with the bank or other boundary of the space of water, loops being attached to their extremities for this purpose; such canvas could be easily spread out or hauled in, and would effectually prevent, while over the water, any evaporation taking place, no matter how dry the atmosphere, or how intense the heat of the sun; neither would this method have the inconvenience that at first it is apparently liable to, of heating the water in the tank, &c., for we know that water cannot be easily heated from above, inasmuch as the water warmed at the surface becomes specifically lighter, and thus being incapable of sinking, forms a superficial stratum, which prevents the propagation of the heat downwards. It is evident that by this method a considerable quantity of the covering, sufficient, indeed, to form a non-evaporating surface over large ponds, water-holes, &c., might be carried by a single horse. When an exploring party, so provided, arrives at a pond, water-hole, &c., they can readily cover it, either by carrying ropes round the piece of water, or by means of one or two men swimming across, holding the ropes attached to the edge of the canvas; thus may be preserved for months a supply, which, if left exposed to the absorbing influence of the atmosphere, would have vanished in the course of a few weeks.

The following extracts, from the work of Lieutenant-Colonel Sir T. L. Mitchell,

Surveyor-General of New South Wales, proves that the preservation of water will hereafter form in Australia the most essential feature in agriculture, and consequently every means adapted to facilitate this object will be of the greatest value in that extensive field for British colonization and enterprise. "With equal truth it may be observed that there is no region of the earth susceptible of so much improvement, solely by the labor and ingenuity of man. If there be no navigable rivers, there are no unwholesome savannas; if there are rocky ranges, they afford at least the means of forming reservoirs of water; and the hand of man alone is wanting to preserve the supply, and regulate its use. Where natural resources exist, but require art and industry for their development, the field is open for the combination of science and skill, the profitable investment of capital, and the useful employment of labor."

The preceding extract distinctly shows (what indeed is confirmed by other travellers) that civilised man will be unable to form permanent settlements in the extensive and fertile regions forming the interior of of Australia, unless he can call to his assistance means adequate to overcome the formidable difficulty presented by want of water, during several months of the year. The method I have invented, by which we can readily and cheaply cover even a large surface of water, will, no doubt, greatly facilitate the accomplishment of what would be otherwise in many localities unattainable. Instead of the expense of vaulting over reservoirs, or covering tanks, we can now make the *water itself support its own roof*—a roof, it is true, thin and delicate of structure, but, nevertheless, by reason of its impermeabity, not less capable of preventing evaporation than if it consisted of the most solid masonry. This floating carpet or roof possesses the great additional advantage of rising or falling, according as the quantity of water in the reservoir increases or diminishes, so that all access of air to its surface, and consequently all evaporation, is prevented. This covering being opaque, will keep the water perfectly in the shade, a circumstance which, combined with deficient ventilation, would in itself much retard evaporation, as is examplified even here by the wetness of roads, overshadowed by trees, and by the water remaining in ditches, when covered by *Lemna* or duck weed, so long after the summer heats have dried up all other ditches in their neighbourhood.

ON THE PREPARATION OF THE SYRUP AND EXTRACT OF QUINQUINA.*

BY M. F. BOUDET.

I HAD the honor last year of entertaining the Société de Pharmacie with the preparation of syrup of quinquina, and of explaining a process which had the advantage of furnishing a product of perfect and unvarying limpidity, and at the same time containing more of the active principles of the quinquina than the syrups prepared in the ordinary manner; but at that time I had not established the value of the process by sufficient experiments. I had still to make some comparative analyses, and I had advanced considerably in this work when the misfortunes which have come so thickly on me put a stop to my researches.

Luckily one of our young members, M. Paul Blondeau, prepared a thesis on this subject which does great honor to his entrance into the pharmaceutical career, and promised to furnish me with the elements of a concluding demonstration. I therefore found the discussion of the advantages of the process, on his observations.

The preparations of quinquina, particularly the extract and syrup, occupy one of the first ranks among officinal medicaments; they have likewise been the objects of numerous experiments on the part of pharmaceutists. The multiplicity of these trials, and especially of late, the contradictory discussions carried on by MM. Guibourt and Soubeiran, in their works, on the extracts of quinquina, prove that much is left to be desired in the formula for these medicines. One circumstance in particular has occupied practitioners: that is the turbid and disagreeable appearance of the solutions of the extract of quinquina made by decoction, and of the syrup of quinquina prepared according to the *Codex*. For my part, I have often been obliged, at the request of medical men, to employ the extract of quinquina by maceration, instead of that by decoction in tonic medicines, and even to filter these draughts, so as to make them endurable to the patients, who otherwise absolutely refused to take them.

As to the syrup of quinquina, I am not afraid of saying, that although it can be obtained clear, either by the process of the *Codex*, by having recourse to filtration, or by some other known process, it becomes turbid in the course of a longer or shorter time, and besides, that as far as the alkaloïds which it contains are concerned, we are far

* *Journal de Pharmacie*, March, 1850.

from having attained the perfection to which we might pretend.

Here is the process which after many trials satisfied me.

This process is based on that so well applied by the authors of the *Codex* of 1837, to the preparation of the syrups of sarsaparilla and ipecacuanha; it consists in exhausting the quinquina by displacement, and treating it with three and a half times its weight of alcohol at 0·56° C. and then with water, so as to obtain a total weight of liquor nearly five times the weight of the quinquina employed, distilling this muddy liquor to recover the alcohol, filtering the remaining liquor on sugar in the water bath, and transforming it into syrup by simple solution.

	gram.
Grey quinquina	96
Alcohol at 0·56° C.	336
Water. Sufficient for extraction—about.....	450
Pounded sugar about	500

The proportion of liquid should be more or less considerable according to the amount of quinquina employed. It must be observed that there is more or less of loss during the distillation according to the importance of the operation. The essential point is not to obtain too fluid an extract so as not to be obliged to evaporate the syrup.

On the other hand, instead of diluting the tincture of quinquina with pure water, there is necessarily an advantage in diluting with the water poured on the quinquina after the alcohol into the displacement funnel, and which carries away the last of the soluble matter contained in the bark.

It is necessary to filter the liquor through coarsely broken sugar, and to stir it from time to time, because if filtered alone, it will soon become turbid and would not form a perfectly limpid syrup.

When the process just indicated is exactly followed, the product continues clear for several years.

I have at this moment some syrup which is three years old, and which has not sustained the slightest change; whilst I have seen the syrup prepared by other processes become after some time turbid. One very remarkable phenomenon has struck both M. P. Blondeau and myself, that is, that the order of the combination of elements of quinquina is not the same in the liquors furnished by decoction or aqueous maceration, and in that obtained by precipitation with water and distillation of the tincture of quinquina. The latter is richer in alkaloïds than the former, and time does not appear to modify its composition, whilst the others are the seat of reactions which cause precipitates even when associated with sugar.

Thus, my process has one advantage, as it gives an invariably and constantly clear product, and that is a real merit, for it is by no means indifferent whether we offer a patient a transparent or turbid syrup; and the transparency of syrups has always been regarded as a proof of their good preparation.

If we now consider this process with regard to the amount of active principles or alkaloïds which the product contains, the superiority seems likewise great: is it not shown, in fact, by the experiments of M. P. Blondeau, that the alcoholic extract of grey quinquina again acted on by water, furnishes an extract which is almost entirely soluble in water, and which contains a much larger proportion of tannin and alkaloïds than the extract by decoction of the same quinquina.

In fact, M. P. Blondeau, by treating 1000 grammes of excellent grey quinquina, which gave 5 grammes 20 centigrammes of alkaloïds, obtained 150 grammes of extract by decoction, which contained in 1000 parts 86 grammes of soluble extract and 0·22 of alkaloïds, whilst by means of alcohol at 56° centigr. he obtained from a similar quantity of the same quinquina 240 grammes of extract, formed of 76 grammes of insoluble matter and 160 grammes of extract soluble in cold water, and containing 2·16 per cent. of alkaloïds. The quinquina then gave, by this process, more extract than by decoction; moreover, this extract was much more rich in organic alkalies, for it contained 2·16 per cent.

Now, in what consists my process, if not in preparing the syrup of quinquina with this extract by alcohol and water or *hydro-alcoholic*, which is so rich in active matters, being always careful to use the extractive liquors themselves, instead of reducing into an extract which must be redissolved in a great quantity of water. This method avoids the useless employment of a considerable portion of water, and the loss from the medicines of some of the extractive parts which become insoluble at each new evaporation.

It is, however, to be observed that the quality of the medicine always remains dependent on the richness of the quinquina used in its preparation, and that richness is very variable, as every one knows, and as is proved by M. P. Blondeau's experiments. To avoid this inconvenience, and to establish a perfectly satisfactory formula, it would be necessary to determine the quantity of *hydro-alcoholic* extract furnished by 100 parts of grey quinquina of good quality, and

taking this quantity as a foundation, to establish between the proportions of sugar and quinquina,—not an invariable proportion, as hitherto done, but, on the contrary, a proportion which should vary with the real value of the quinquina employed; that is to say, with the weight of *hydro-alcoholic* extract which it gives in a previous experiment.

M. Blondeau obtained 16 per cent. of *hydro-alcoholic* extract from some excellent quinquina. I have myself obtained 18 per cent. from some very bitter grey quinquina. M. Blondeau's number may be taken, and then the formula for syrup of quinquina would be—

	grammes.
Grey quinquina sufficient to produce of hydro-alcoholic extract	10
Sugar.....	500

Alcohol at 56° C., 3½ parts to 1 part of quinquina; water, Q. S. for extracting 450 grammes. Distil off the alcohol, filter the liquor remaining in the retort over the sugar, and make a syrup by simple solution.

It also results from my observations, and those of MM. P. Blondeau and Soubeiran, that it would be very advantageous in medical practice to substitute for the extract of quinquina of the codex made by decoction, this same extract made by the hydro-alcoholic method, which, as has been proved by analysis, has the advantage of being much more rich in alkaloïd. This extract should be prepared in the following manner:

	grammes.
℞ Grey quinquina in coarse powder	1000
Alcohol, at 56° C.	3500
Distilled water, q. s.	

Exhaust the quinquina by displacement, first by means of alcohol and afterwards with water, in sufficient quantity to obtain 5000 grammes of hydro-alcoholic extract; distil this extract. to collect the alcohol; allow it to cool; filter and evaporate to the consistence of an extract.

I hope that the foregoing observations are of a nature to convince practitioners that the formula which I propose for the syrup of quinquina is preferable to all those which have hitherto been published, and that the hydro-alcoholic extract of quinquina is superior, in all respects, to the simply aqueous extracts. I wish I could also hope to see these preparations adopted in pharmaceutical practice; but the Codex compels pharmaceutical chemists to allow proposed improvements in officinal preparations to sleep in our journals and treatises, until the government thinks proper to cause the publication of a new edition. I cannot too strongly express my regret in this respect. No one professes and observes a higher respect for accredited formulæ. Diascordium, theriacum, and pills of cynoglossum, are, for example, medicaments impressed with an immobility against which no serious objection can be raised; but it is not the same with the syrups and extracts, which are so much the more perfect as they reproduce more exactly the active principles of the substances used in their preparation, and which are really improved by all the means which can render this reproduction more accurate. Is it not, then, to be deplored that processes invested with official sanction should alone be authorised, whilst others, evidently preferable, are interdicted? Again, if an appendix to the Codex were published, from time to time, including all the most positive acquisitions of science, a little patience would enable us to bear the temporary privation; but Pharmacy, in France, has submitted to the Codex of 1837 for thirteen years, waiting for the progress made in that time to be legalised. It is too long, unquestionably; and, in the age in which we live, such a state of things should cease as soon as noticed.

ON THE COPALCHI, BARK, A NEW AND VALUABLE BITTER ANALOGOUS TO THE CASCARILLA.

BY JAMES STARK, M.D., FELLOW OF THE ROYAL COLLEGE OF PHYSICIANS, EDINBURGH.

In the course of some enquiries into the remedies used in Chili and Peru, I received from one of my correspondents in Chili a bitter bark under the name of *natri*, which was stated to be much employed by the medical practitioners and natives of Chili in the treatment of intermittent and other fevers, and held in higher repute than even Peruvian bark itself. The bark and leaves sent enabled me to ascertain that the natri was the produce of a species of croton; but, from the want of the flowers and fruit, the particular species could not be ascertained.

In the course of a correspondence with my friend, John Elliot Howard, Esq., of Tottenham, he mentioned to me that a quantity of bark had been received by the Messrs. Gibbs, of London, from San Blas, which appeared to be analogous to, if not identical with, the *natri*. A small quantity of the same bark had also been brought over from Santa Cruz, by a gentleman, who stated that it was there known under the name of *chiquique*, and was always

given to the Indians in fever cases, and was considered by the medical practitioners there superior, in certain cases, to Cinchona bark itself.

Mr. Howard at once recognised this bark as the copalchi bark of Goebel; a valuable Mexican bitter, described by him as the product of the *croton suberosum;* and through the liberality of the Messrs. Gibbs, that gentleman sent me first a few pounds to make trial of it in practice, and then the whole quantity imported into this country.

Although it has not been in my power to lay my hands on Goebel's description, I have satisfied myself as to this bark being that known in Europe since 1825, and described by the names of *copalchi bark*, and *quina blanca*,—the product of one tree, variously termed *croton suberosum* by Humboldt, Bonpland, Kunth, etc.; *croton pseudo-china* by Schlechtendal and Nees Von Esenbeck; and *croton cascarilla* by Professor Don.

The description of this bark given in the *Dictionnaire Universelle de Matière Médicale* exactly corresponds with the specimens in my possession, as does also that given in the *Dict. des Drogues Simples et Composés.* In these articles it is described as a new and valuable bitter used in Mexico, similar in properties to cascarilla, and believed to be the product of the *croton suberosum* of Humboldt.

It is to Schiede and to Nees Von Esenbeck, however, that we are chiefly indebted for ascertaining the exact species of plant which yields the copalchi bark; and showing by their descriptions and figures that the tree which they describe as yielding it, is that formerly called by Humboldt, the *croton suberosum.* Schiede, as well as Nees Von Esenbeck, found this copalchi (which is the Indian name) sold in the apothecaries' and druggists' shops at Jalapa, and over the province of Mexico, under the name of *quina blanca*, and considered by them as the finest and best sort of cascarilla. Indeed, Schiede was so convinced that he had discovered the true source of the best cascarilla, that, from the examination of the tree which produces this *quina blanca*, he asserted that the best cascarilla was the produce of the *croton pseudo-china* of Schlechtendal—now called, by Professor Don, the *croton cascarilla.*

Nees Von Esenbeck only went the length of considering the copalchi as closely resembling the cascarilla; and gave, in the supplement to his splendid work, the *Plantæ Medicinales*, most beautiful colored figures of the copalké-croton in all its states—flowers, fruit, leaves, and bark—rendering it perfectly impossible ever hereafter to mistake the bark or plant which he describes. He also terms the tree the *croton pseudo-china.*

Copalchi bark was subjected to a minute analysis by Mercadieu, in 1825, who found it to contain no crystallisable alkaloïd, but the following principles: 1, an astringent matter of a deep brown color; 2, an excessively bitter principle (containing also an astringent principle), soluble in water.—It is in this bitter principle that the febrifuge properties reside which the physicians at Vera Cruz have recognized it to possess; 3, a green fatty substance; 4, a clear brown resin, insipid and inodorous; 5, a brown animalised coloring matter, insoluble in ether and absolute alcohol, but soluble in dilute alcohol and in water; 6, starch; 7, woody fibre; 8, phosphate and oxalate of lime. The burnt ashes yielded hydrochlorate and sulphate of potassa, oxides of iron and manganese, carbonate and phosphate of lime, with traces of magnesia and silica.

Brandes, who analysed this bark the year following, could not detect any crystallised alkaloïd, but recognised the bitter principle on which its active properties depended—a resin, concrete fatty oil, etc.

This bark is now undergoing a minute analysis by D'Douglas Maclagan and D'Anderson. Meanwhile, my friend, Mr. Howard, has made some trials to prepare the bitter principle in a pure state. The bark was exhausted by almost absolute alcohol; this tincture evaporated to dryness; the bitter principle removed from this extract by cold water, which left the residuum of waxy matter; and, on evaporating this aqueous solution to dryness, the bitter principle was obtained in dark brown, almost black, lustrous, but non-crystalline, scales, of an intensely bitter taste. The bitter principle thus procured, possessed the strange property of being deliquescent, requiring to be kept in closely stoppered phials.

Copalchi bark yields an agreeable aromatic, bitter to water, but especially to proof spirit. The tincture and spirituous extract, indeed, are agreeably aromatic, and, on first tasting, leave on the tongue and palate a sweetish taste.

Since I received the first samples of copalchi bark, I have made trial of it in a few cases, which seemed tolerably well fitted for testing its properties, if it possessed any.

The first case was one of atony of the stomach and bowels, with weak and imperfect digestion, and irregular actions of the bowels; at one time costiveness, at another slight diarrhœa, existing. In this case, the usual bitters, as gentian, quassia,

and columba, disagreed, exciting nausea, &c.; while Peruvian bark and quinine increased the head-ach, and induced a feverish state of the system. The case, however, wonderfully improved under the use of the simple infusion of the copalchi of the strength of half an ounce of bark to a pint of boiling water, given in table-spoonful doses, three times a day.

In the second case in which trial was made of copalchi bark, the patient suffered from irregularity of the bowels, but with this peculiarity (several instances of which came under my notice in the past winter during the prevalence of cholera), that twice daily, viz., at 3 p.m. and 3 a.m., more or less violent spasmodic cramp in the bowels came on, preceded by shiverings and coldness, and terminating in a sweating stage. Quinine in 1½ grain doses, twice daily had been given for two days, with the effect of completely checking these intermittent paroxysms, when it was obliged to be stopped, in consequence of its inducing violent head-aches, flushing of the face, and feverishness. The paroxysms immediately returned as before, but, on substituting infusion of copalchi, giving a wine glassful at 2. p.m., and the same quantity at bed time, the paroxysms were arrested, and have not since returned.

Similar relief followed in another but milder case of the same nature. In this case, the cure was trusted to the copalchi alone, no other medicine being given, in order to see whether it really possessed any antiperiodic powers. It is, therefore, scarcely possible to doubt that it possesses some antiperiodic virtue, so that we can easily believe what is stated of its powers by the Mexican and Peruvian physicians in arresting the paroxysms of intermittent fevers.

It has been used in several other cases, but without the results being so striking as to render its superiority to other bitters unquestionable. I am at present giving it in a case of epilepsy, in which all other bitters had disagreed, excepting that much neglected but valuable bitter, the trefoil (Menyanthis trifoliata), and the case, so far as it has gone, has succeeded satisfactorily under the use of copalchi bark. Dr. Bennett informs me that he is administering it in an epileptic case in the Royal Infirmary, apparently with marked benefit.

When I received the first few pounds of copalchi bark, I sent some to the Royal Infirmary, and to the two principal dispensaries, in order that it might get a fair trial. I have not yet received reports from these institutions, but learn that in every case in which this bitter has been administered, it has given satisfaction, proving an agreeable light bitter. Being now in possession of the whole importation of this bark, through the liberality of the Messrs. Gibbs, and being anxious that its powers should be fairly and thoroughly tested by the medical men of Edinburgh, parcels of it have been sent to the Royal Infirmary, to the New Town and Royal Dispensaries, and to the Leith Dispensary; and the remainder lies with the Messrs. Duncan & Co., druggists, at whose shops, in Edinburgh and Leith, small quantities of the bark may be gratuitously obtained by those who wish to prepare it for themselves. The Messrs. Duncan & Co. will also keep the infusion, decoction, tincture and spirituous extract ready for prescription, charging merely for the trouble and cost of materials used in the preparation, as the bark itself is *not to be sold* at present. Should the bark be found to prove a valuable addition to our stock of bitters, it could soon be procured from Mexico and Peru in any desired quantity; meanwhile, I would invite the profession in Edinburgh to make trial of it, and shall feel much obliged if they will make the results of their trials known to me.

It appears to me, that one of the great wants in the medical practice of the present day is, a good light bitter of some real therapeutic powers. Most of the bitters in common use are harsh, disagreeable and heavy, often exciting nausea, aggravating rather than allaying the irritability of a stomach already too irritable. To avoid these it has become of late too much the practice to employ quinine, bebeerine, strychnia, or other concentrated bitters or alkaloïds, which in many cases do more harm than good. I am satisfied of this, that in dyspeptic cases especially, by employing the alkaloïds or bitter principles separated from the aromatic, resinous, or other principles with which they are usually associated, we destroy, to a great extent, the therapeutic powers of the drug, and fail to derive those benefits which we should receive from making use of a spirituous extract, a tincture, or even the simple infusion or decoction of the drug. The warm aromatic principles, associated with the powerful bitter in the Copalchi, seem to me to supply the want of a light bitter, which most practitioners must have experienced; and it is to be hoped that it will succeed in the hands of others as much as it has yet done in mine.

It may be remarked that the infusion and decoction of Copalchi are best made of the strength of half an ounce of bark to one

pint of water. The tincture with one ounce of bark to one pint of proof spirit. The dose of the infusion and decoction is a tablespoonful or small wineglassful twice or thrice daily. Of the tincture, one or two teaspoonfuls, or of the extract, from one to two grains, twice or thrice daily.

As Copalchi bark yields freely much coloring matter, might it not be advantageously employed in dyeing? One, at least, of the crotons yields a valuable dye; and even the cascarilla itself is used in France as a dye-stuff, yielding a rich black color, which is easily fixed on stuffs little fitted for receiving fine dyes.

OBSERVATIONS ON THE CHEMICAL CHARACTERS OF POISONING BY PHOSPHORUS.*

BY J. L. LASSAIGNE.

In a case in which I was consulted with MM. Chevallier and Duchesne, on a suspicion of poisoning by some phosphuretted paste, we made some trials which gave us negative results.

Being desirous of checking by experiment the processes which we had adopted in this case, we operated on the dejections of an animal poisoned by a phosphuretted paste as well as on the organs which had been removed. Our object in undertaking these experiments was, not to observe the symptoms and alterations produced by this poisonous agent, and which have already been sufficiently described by Orfila and other toxicologists, but to endeavor to find a process of proving its presence.

The observations which we now publish were made on a young spaniel dog, which died *five days* after taking into the stomach a drink composed of sweetened water in which were mixed 4 grammes of a farinaceous phosphuretted paste containing two grammes of phosphorus.

Half an hour after administering this poison, the animal ate some bread and milk without repugnance. No peculiar symptom having manifested itself at the expiration of an hour, the animal was put into an apartment where he was watched. In about two hours, a portion of the bread and milk was vomited; this vomit was left to the air for five days on the bricks which it covered. After this first vomiting, there was another, but occasioned by a liquid, yellowish and viscid dejection, analogous to bile: this last dejection was alkaline, whilst the first very powerfully reddened litmus paper. The animal then appeared to be suffering; it trembled; and stood up with difficulty. From this time, it refused the food and drink presented to it.

During the four days following, it remained sorrowful, without presenting any other symptom. Finally, during the night of the fourth and fifth day, it died in the kennel in which it had been replaced. The examination of the body was made soon after death, for it was still warm when that operation was performed. The stomach and intestines were free from solid substances; their mucous membrane was much inflamed as far as the lower portions of the rectum; the stomach contained a small quantity of a yellowish bilious liquid, *very alkaline* to reddened litmus paper. The analysis of this liquid presented with the biliary elements a certain quantity of alkaline phosphate, the proportion of which appeared to us to be larger than the same quantity of bile in the normal state would contain. However, the searches which we made on the tissue of the stomach which had been treated partly with sulphuric ether and partly with liquid chlorine, did not demonstrate the presence of free phosphorous in that organ or in the other portions of the digestive tube.

The examination of the stomachal dejections dried on the brick, as above mentioned, showed us, *after five days'* exposure to the air, that the matters composing them exhaled a powerful odor of garlic, and appeared phosphorescent when rubbed in the dark. A portion of these matters, introduced into a flask with from eight to ten times its weight of pure sulphuric ether, yielded to that liquid a certain quantity of phosphorus and fatty matter, for the product of the spontaneous evaporation of the ether had the appearance and consistence of melted butter; heated on a spatula, it burned with a very vivid yellowish flame, giving off a very acid smoke; the charcoal left on the spatula was acid to the taste and yielded to water phosphoric acid, which lime water abundantly precipitated in white flocks.

A second portion of the matter of these dejections was boiled with water acidulated with sulphuric acid; there was deposited at the bottom of the vessel, a yellow, semi-fluid matter, which solidified by cooling: this matter presented in its odor and combustibility the characters of impure phosphorus.

Finally, a last portion of these dejections, treated with 15 times its weight of distilled water, was submitted to the prolonged action of a current of gaseous chlorine. By the contact of this gas a certain quantity of

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phosphorus was converted into phosphoric acid which was found in the residue of the evaporation of the chlouretted liquid.

From these facts it results:—

1. That, in the poisoning by phosphorus in question, the greater part of this body was rejected by vomiting and found among the substances, even after five days' exposure to the air.

2. That it was impossible, after this lapse of time, to find any trace of free phosphorus in the digestive organs.

3. That it is probable that the inflammation observed throughout the length of the digestive tube is owing to the phosphoric and phosphorous acids which are formed, and were afterwards absorbed and saturated by the alkaline liquids which are poured into different parts of the intestinal canal

4. That it will always be important, in the cases of suspicion of poisoning by *phosphorus* or phosphuretted preparations, to examine the dejections to detect the presence of phosphorus, even after a prolonged exposure to the air.

NOTES AND EXPERIMENTS ON ERYTHROSE—THE COLORING MATTER OF RHUBARB.*

LETTER FROM M. MEUREIN TO M. GAROT.

In repeating your experiments, the results of which have been perfectly identical with those which you have announced, (see *The Chemist* No. 4, January 1850, page 180), I asked myself the following questions:—What part of the root of rhubarb is it that gives rise to the erythrose? Is it the soluble or the insoluble principles? Is the root of rhubarb, exhausted of its soluble principles by the various menstrua employed in pharmaceutical operations, capable of furnishing erythrose?

In a word, can pharmaceutists employ, with success, for the preparation of this coloring principle, the residues of rhubarb used for preparing the syrup, extract and alcoholic tincture?

1. To solve these questions, I exhausted by maceration in cold water, a certain quantity of rhubarb; the dried residue weighed 4 grammes; treated by nitric acid, washed and dried, the product obtained weighed 90 centigrammes and was of a light orange yellow color; treated by ammonia it gave rise to the characteristic beautiful purple color, but the quantity of coloring principle was less than with an equal quantity of erythrose resulting from rhubarb not previously exhausted.

2. A residue of rhubarb exhausted by weak alcohol, weighing 2 grammes, gave 40 centigrammes, which, treated by ammonia, produced a deep brick red color, without the violet reflection which constitutes purple.

3. A residue exhausted by infusion and dried, weighing 2 grammes, gave 45 centigrammes of erythrose. Ammonia developed in it a very bright red color without violet reflection.

4. One gramme of alcoholic extract treated by nitric acid, then diluted with a large quantity of water, gave a precipitate which was orange yellow at first, passing to deep red brown by successive washings. The clear liquid resulting from the filtration was at first yellow, then when it was no longer acid, it became of the color of the residue which remained on the filter. This residue, dried and treated by ammonia, gave an analogous color—that of the erythrosate produced by the residue of the foot exhausted by alcohol.

5. One gramme of aqueous extract treated by nitric acid, then diluted with water, washed, filtered and dried, gave a residue—orange yellow erythrose—which, treated by ammonia, produced a purple color nearly resembling that of the erythrose obtained from the unexhausted root, but less vivid.

The erythrose obtained from experiments 1, 2 and 3, treated by ammonia, left an insoluble very pale red residue, of an abundant ligneous aspect, not containing pectine as when operating on unexhausted rhubarb. The quantity of coloring principle does not appear sufficiently abundant for submitting with advantage these exhausted residues to the treatment by nitric acid and ammonia.

The aqueous and alcoholic extracts appear to contain almost the whole of the principles converted into erythrose by nitric acid. However, alcohol exerts a remarkable action on rhubarb, for the erythrose obtained from the alcoholic extract and from the residue of the exhaustion of the root by alcohol, being treated by ammonia did not give the purple color, but deep red.

In experiments 1, 2 and 3, you will remark that the residues gave from 20 to 24 per cent of erythrose (very impure), a quantity equal to the production of the unexhausted root, but a great part of this product does not undergo, as I have said above, any modification by ammonia.

From all the foregoing, it results that it is the soluble extractive part of rhubarb which appears to furnish the largest quantity of erythrose.

* *Journal de Pharmacie*, March, 1850.

That the residues of the root, exhausted by various menstrua, treated by nitric acid, furnishing only a small quantity of erythrose, cannot be turned to account for obtaining this coloring principle.

That, finally, to obtain erythrose of good quality and in abundance, it appears that nitric acid should act simultaneously on the soluble and insoluble portions of the rhubarb, without any previous preparation.

ON THE EXTRACTION OF CROTON OIL.*

BY M. G. GUIBOURT.

Letter to M. Félix Boudet.

When a process for the extraction of the oil from the *Croton tiglium* was published in the *Journal de Pharmacie et de Chimie* of last year (see The Chemist, new series, No. 1, p. 38), I intended to have added some observations, but did not do so, hearing that you had the same intention; now that you have for a time given this up, I send you the results of my observations, and will leave to you the further examination of this subject, which is far from being exhausted.

Some of the observations that I was about to submit to the author of the process have been already addressed to him by M. Hainaut, pharmaceutist at Courcelles (Belgium), in the *Journal de Pharmacie d'Anvers*. I resume them in a few words:

1st. How can we believe that croton seeds treated with ether only produce 18 per cent. of oil, but that the addition of a third of alcohol at 95 per cent. will give 50 per cent.? Is it not certain, on the contrary, that ether is fitter than alcohol for the extraction of all the fatty bodies in the croton seeds, and that it is even to the quantity of fatty, inert oil dissolved by the ether that we must attribute the weak rubefaciant property of oil obtained in this way?

2nd. How can we admit that ether employed alone gives an almost inert oil, and that the addition of a third of highly rectified alcohol suffices to give the product all its activity? Must we not suppose, on the contrary, that the oil obtained by ether containing only ¼ of its weight of alcohol would be much more active than the other?

3rd. The author is mistaken in supposing that exposure to the air during several days will suffice to remove the ether entirely. I have extracted too many vegetable oils by this means not to be certain that these fatty bodies obstinately retain a portion of ether, which they only yield by bringing to the boiling point and by assisting the volatilisation by constant agitation. I must add that the spontaneous volatilisation of ether will be effected with less ease when the tension of its vapor is diminished by its mixture with alcohol.

4th. As to removing the alcohol by simple decantation as the author imagines he can do, there is nothing less possible as M. Hainaut has observed.

5th. As the ether used for the extraction of the vegetable oils should be perfectly pure, so as not to injure their peculiar qualities, the price of it must materially augment that of the croton oil. Were the product better, the pharmaceutist would not regard this; but as it is worse, that is another reason for not rendering it more expensive.

After criticising the new process for the extraction of croton oil, I must request permission to defend that which I gave in my *Pharmacopée raisonnée*.

This process, which was not exactly described by our comrade nor M. Hainaut, consists of a first expression of the seeds cleansed and passed through the mill, followed by a second expression aided by the action of alcohol. The only observation which I have to make to-day, not on the process itself but on its results, is that having at first a very bad press, I obtained but little oil by simple pressure or even with the aid of alcohol, and that I only obtained, in all, 39·5 per cent of the weight of the peeled kernels, or 19 per cent. of the weight of the entire fruit. When I afterwards operated with a good press I obtained much more advantageous results.

840 grammes of peeled kernels of *croton tiglium* gave me at a first pressure without heat, 350 grammes, or 41·6 per cent. of a fluid, inodorous oil, of the color of pale Malaga wine. The cake, passed again through the mill, mingled with alcohol, (only 200 grammes), heated in a water bath and pressed again gave 90 grammes of a brown oil, thicker than the first and with an odor of jalap. The two quantities united gave 52 per cent. of the weight of the peeled kernels.

Another time, one kilog. of peeled kernels gave me altogether, 660 grammes of oil.

The oil thus obtained should be put to stand for some time in a cool place, so that it may deposit a portion of solid fat; it is then filtered through paper. It is then liquid, transparent, and of the color of pale Malaga wine, and sufficiently active for 5 or 6 drops to produce an erysipelatous

* *Journal de Pharmacie et de Chimie*, March, 1850.

eruption on a child's skin. I have sold a great quantity of this oil, being a practicing pharmaceutist, in consequence of the superiority of its action over the greater part of what could be obtained elsewhere.

It has been proposed to dispense with peeling the seeds of the croton in consequence of the inconvenience of the process. I imagine that it is scarcely practicable in operating on a large scale for commerce; but I speak here chiefly for practising pharmaceutists, who may wish to prepare their medicines themselves, so that they may be able to answer for their good quality; and I can assure them, having often done it myself, that this operation presents no inconvenience provided you are careful not to put your hands to your face and to wash them with soap each time you leave the picking. The operation is easily done in other respects by means of a slight blow with a hammer, which breaks the shell and liberates the kernel; and it has many advantages.

1. We are able to remove the Mexico seeds which are frequently found mixed with the croton seeds, to the great detriment of the efficacy of the oil.*

2. All the spoiled kernels, which are browned or which have lost the greater part of their oil, which has left them to impregnate their covering.

3. The subtraction of the shells diminishing the weight of the grains nearly half, it may be conceived that there is great advantage in submitting to pressure only 500 grammes, for example, of an eminently oily kernel, instead of pressing it with an equal weight of dry matter, which renders the expression of the oil more difficult, and which certainly retains a portion in the cake.

As to the total amount, whether we add, as I have always done, the product of the second pressing to that of the first; or if we confine ourselves to the already very considerable produce of the first operation, this process appears to me preferable to and more advantageous than the one recently proposed in the *Journal de Pharmacie.*

It must not be supposed that there is much difference in the efficacy of the two products mentioned. Independent of the comparative experiment made by M. Piédagnel, which proves it, I have obtained a similar result with oil of *euphorbia lathyris*, which is not without analogy to that of croton. 1150 grammes of euphorbia seeds, not deprived of episperm,* furnished, by the first pressure, 358 grammes of oil of a golden yellow color, inodorous and of a pleasant flavor; and, by means of alcohol, 80 grammes of an oil a good deal darker colored, thicker and odorous, but still not of an unpleasant taste. These two oils were sent separately to M. Martin-Solon; this clever practitioner found that they purged, without any appreciable difference, at a dose of 2 to 3 grammes, and equally caused colic to the patients.

* On this occasion, I may say that I have recently ascertained that some highly respectable tradesmen in Paris *still* sell, in all good faith, seeds of the *jatropha curcas* for those of the *croton tiglium.* This is undoubtedly the reason of the little efficacy of a good deal of the croton oil of commerce, and which is often supposed to be the fault of the mode of preparing it.

ON THE PREPARATION OF PEPPERMINT LOZENGES.†

BY M. MIALHE.

ALTHOUGH peppermint lozenges are included in the *Codex*, and are found in every pharmaceutical establishment, very few pharmaceutists prepare them themselves, This is evidently wrong, for the lozenges of commerce are frequently prepared with essence of peppermint adulterated with various similar volatile oils and even with essence of turpentine.

It therefore appeared to me time to show the *modus faciendi* of this preparation, with some details which daily experience has enabled me to collect.

To choose essence of peppermint.—The following result of my observations confirms those of M. Méro de Grasse: French essence of peppermint is preferable to English, contrary to the generally received opinion; this essence should have been subjected to rectification in order to remove a coloring resinous matter which gives harshness and makes it become thick with time; this essence does not lose its strength with age, but it loses an herbaceous odor which it has when recently prepared, and consequently it should not be used until at least a year after its preparation.

Choice and preparation of the sugar.—Cane sugar is preferable to beet-root sugar for the preparation of peppermint lozenges, because it is less liable to discolor under the influence of heat; the sugar should only be pounded as it is wanted, because crystal-

* These seeds, being much smaller than the croton, cannot be peeled.

† *Journal de Pharmacie et de Chimie*, March, 1850.

lisable sugar when pounded is apt to pass partly into the state of grape sugar, or at least into uncrystallisable sugar, both of which sugars have the inconvenience of becoming brown when heated with a small quantity of an alkaline or earthy base, and especially with lime; a substance which, as is well known, always exists in a considerable proportion in refined sugars.

Sugar intended for the preparation of dropped lozenges, such as peppermint, should be powdered in the following manner: it should be lightly pounded, without rubbing, in a marble mortar; passed through a hair sieve with very large meshes, and when all sifted, passed again through a silk sieve, and those portions which do not go through the sieve should be used in the preparation of the lozenges.

Peppermint lozenges.	grs.
Pounded white sugar.....	1000
Water.....	120
Essence of peppermint.....	8
Rectified spirit.....	8

Mix the sugar and the water in an appropriate vessel, and the essence and spirit in a flask; then put 125 grammes of the saccharine mixture into a skillet with a handle provided with a lip at the left side; heat quickly over a charcoal fire, continually stirring it, until the mixture begins to boil; add two grammes of the alcoholised essence, remove the saucepan from the fire, continuing to stir it; as soon as the alcohol has evaporated, take the skillet in the left hand, place it in such a manner that the lip is turned towards you, incline it as though you intended pouring out the contents drop by drop, and then with an iron wire of 20 centimetres long with a wooden handle, cause the mixture to fall drop by drop in rows on very clean sheets of tin, taking care to hold the drop quite close to the tin; remove the drops from the lip of the saucepan slowly at first, then quicker as the saccharine paste cools. Remove the lozenges with a card and place them on a sieve covered with paper, and dry them in a moderately warm oven, or better still in the open air.

Operating as thus described, it is easy with a little practice, which is soon acquired, to prepare a kilogramme of lozenges in an hour.

These lozenges have every quality we could wish. Although prepared with less essence than most authors recommend, they have a very powerful flavor of peppermint, and rather too strong than too weak.

REPLY TO A FRIEND OF LIEBIG.

GENTLEMEN—I grieve to be compelled again to trespass on your valuable space, —cumbering ground that might be better occupied— with the unprofitable offspring of a foolish controversy; as, however your correspondent assures us he pursues chemistry for fame alone, and doubtless hopes to reap a rich reward from his astonishing productions in this journal, I was in hopes that, by incontinently sticking to him, I too might eventually be permitted to pick up the crumbs of glory that fall from his abundant table.

Kind advice and gentle admonition appear to be lost on my dogmatic friend; I feel compelled unwillingly to say, that a gentleman who claims the privilege of setting all the world right for his amusement, and denounces his opponents as nobodies and "mites," should shew some other fitness for the arduous task, than stupid arrogance and insensate pride, and the total absence of all gentlemanly courtesy towards the unlucky objects of his rectifying functions.

In his blundering and obscure epistle he has, however, said one good thing; he calls his labors for my extinction, "employing a sledge hammer to crush a mite." I believe the comparison a good one; the arguments he uses, and the names he calls upon, ensure the proper disproportion between "means and end," while the influence his extinguishers have had on me very much resemble the probable result of an attempt to crush a mite with such an instrument—my enemy has hit his own fingers, but missed me.

It must be very evident to every impartial man that the influence of arsenious acid upon albumen is still an open question, which the partial light of science has not yet enabled her sons definitively and unanimously to decide It appears to me that it is every chemist's business to study carefully all credible authorities, and then by experiment endeavor to decide the question for himself, and that his right to do so is not at all influenced by his position in the chemical world.

It will not escape your readers' observation that this is the only principle we ever attempted to maintain, carefully reserving all the time our own opinion on the particular theory before us. I am, therefore, in strict justice, quite absolved from any obligation to reply to the braggadocios (for they are nothing more) of your boasting correspondent, lest, however, such a silence should be misconstrued, we will in a word or two examine these tremendous statements.

He says, "I claim in decided terms for Dr. Brett equal FALLIBILITY with the celebrated German." Poor man! he means, I suppose, equal *infallibility*; this I dismiss

with a simple denial, after correcting the stupid blunder.

He asks what is my reply to Dr. Muspratt's paper in your journal. Of course I did not go out of my way to answer Dr. M.; but since my opponent brings him into court, my reply is this: that other people quite as wise as he have examined the question and come to a very opposite conclusion, and that the general opinion is that the doctor did not wash his precipitate properly.

The next paragraph I cannot understand. He then says my cause is miserable and I state absurdities, because a Mr. Edwards is mentioned. Sir, I referred to Mr. Edwards, because a paper by him on this very question was lately read before the Chemical Society. If my opponent cannot answer the reasoning it contains, or wait till it is published in the Society's Journal,* he will only make himself ridiculous by impertinent and vaporing challenges which no man of sense or honor could or would accept.

The gentleman's £100 is quite safe, or I much mistake Mr. Edwards.

The last paragraph but one contains one of the usual "puffs" on Dr. Muspratt; for an exposition of him and his attainments I would beg to refer your readers to a recent letter by Mr. Spencer, published in the Liverpool Mercury. I cannot help expressing my astonishment at the way in which he and his college are introduced into all my antagonist has to say.

My opponent comes out in concluding in a mild and amiable style, disclaims *all* personal malice, and says he is an enemy to no man—but we would add, Himself.

ALPHA.

London, 15th March, 1850.

* Published since the date of this letter.

HOMŒOPATHIC HOSPITALS.

On the 10th ult., "at two public dinners, which took place in London—the one at the London Tavern (chairman, Lord Robert Grosvenor, M. P.); the other at the Albion Tavern (chairman, the Earl of Essex)—a sum amounting to £2660 was subscribed for the maintenance of Homœopathic Hospitals in this metropolis. Is not this most disgusting? Lord Robert Grosvenor was the first distinguished aristocratic patron of the quackish humbug called homœopathy in this metropolis; and the noble lord, in all probability, is aware of that fact: but it is more than probable that Lord Robert Grosvenor is not aware that he has inflicted a greater injury on the cause of legitimate medicine in this country than any man who is now living, or who has ever lived." (*Lancet*). We quite agree with our respected cotemporary, that this is most disgusting, and that homœopathy is a quackish humbug; but the establishment of Hospitals will be the shortest road to public condemnation. The lamentable effects of the absence of proper medical treatment on such poor creatures as may be deluded into going into these hospitals, will be the best refutation of the absurd theories of Hahnemann, and the most effectual exposure of the motives of those who put them in practice The homœopathists are most industriously preparing a rod for the flagellation of their own backs. Really, the health and lives of the poor should be guarded against such danger. The Government should take up the subject, and prevent the practice of dangerous quackery.

A NEW HOMŒOPATHIC DODGE.

Our attention was attracted by an advertisement in *The Times* of the 24th of April, which, as it seems to be a novel mode of bringing the serious dangers of homœopathy into greater play, demands particular attention. We have some notion as to who is the advertiser, and warn him that we shall keep a vigilant eye on his proceedings. The following is the advertisement in question.

"HOMŒOPATHY.—Instruction is offered to Ladies, Clergymen, &c., by a retired practical physician, whose desire it is to qualify benevolent persons for treating diseases among their neighboring poor, whereby much expense and suffering will be spared. For particulars apply by letter (post paid) to Dr. H. M. D., 221, Regent Street."

"Ladies, clergymen, &c.," are to be the means of propagating this delusion through the agency of Dr. H. M. D., who, of course, will (contrary to the homœopathic doctrine) "bleed" the said "ladies and clergymen" pretty profusely. Certainly he has made a good selection. Ladies and clergymen had better keep to their household and ecclesiastical duties, and leave the treatment of disease to those who have qualified themselves for the task. Certainly they will do well to keep themselves out of the hands of this Dr. H. M. D.

NEUBER'S LIQUID GLUE.

We have received a sample of this glue, and find it to be a very excellent preparation.

IV. REVIEWS, NOTICES OF BOOKS, &c.

A CYCLOPEDIA OF AGRICULTURE, PRACTICAL AND SCIENTIFIC, IN WHICH THE THEORY, THE ART AND THE BUSINESS OF FARMING IN ALL THEIR DEPARTMENTS ARE THOROUGHLY AND PRACTICALLY TREATED, BY UPWARDS OF FIFTY OF THE MOST EMINENT FARMERS, LAND AGENTS, AND SCIENTIFIC MEN OF THE DAY. Edited by JOHN C. MORTON, Editor of the *Agricultural Gazette*. Glasgow: Blackie and Son.

THIS is by far the best work on agriculture which we have yet seen. The resources of Chemistry, Botany, Mineralogy, Entomology, Meteorology, Natural History, and even many of the arts and manufactures are all combined together with reference to the one special object of good practical farming, whilst in this latter the information is of that thorough business and work-a-day character which will insure it as hearty a welcome in the cottage as its more scientific attractions cannot fail to command in the hall or castle. The circumstances of the times require such a work, and gladly therefore do we hail its appearance at this opportune moment. The agricultural interest has been assailed by the general interest of the whole kingdom, and even high farming is now but a doubtful business. Bad farming is therefore out of the question altogether, and we may shortly hope to learn that a bad farmer is as rare in Britain as a native wolf or hyena. If not destroyed by improvement, the race will be extirpated by famine and the poorhouse. Farmers, then, should look their difficulties in the face, and in the words of our immortal hero, Nelson, remember that "England expects every man to do his duty." When this is done, and the whole available portion of the island brought into thorough cultivation, then will be the time to agitate the question of protection, if protection be then sought for, which we somewhat doubt. But until the public is thoroughly convinced that everything has been done which can be done to defy foreign competition, it is but a mere waste of time and eloquence to babble about protection. It will never be granted until our fields are models of agricultural skill, our rents reduced to a comparative minimum, and our farms managed like our manufactories, that is in such a way as to make the most of everything in the shape of refuse; when that period arrives, if farming is seen to pay worse than other business investments, then will the nation listen, not as a favor, but as a matter of right, to the plea of protection. Meantime every agriculturist ought to be up and stirring. To all such we recommend the "Cyclopedia of Agriculture" as a sure foundation on which to erect a superstructure of practical knowledge, and a fertile soil for the growth of real information. Our space unfortunately prevents us from quoting, as we willingly would do, largely from this work. The articles Farm Accounts, Analysis, Artificial Manures, Arboriculture, Blood, Beer, Blight, Bones, Ashes, Barley, and the Calendar of Farm Operations are surpassed by nothing yet published, even exclusively, on these subjects, and the original hints and practical suggestions interspersed by the numerous illustrious contributors, are certain ere long to take root and flourish. The article upon the Alpaca is admirable, and completely demonstrates the advantages to be derived by the introduction of this animal into our present farm stock; the most barren wastes, unsuited to the spade or plough, will feed alpacas; they will browse on the heather and wild grapes of our moors, our peat-bogs covered with alpine plants would afford them sustenance during great part of the year, and, in short, they might be profitably fed upon that which all other live stock refuse. Then, as to value, a single alpaca, in wool, carcase, and skin, would bring in at least £5 10s. Can we say more than that the work is also very cheap.

TO CORRESPONDENTS.

"MR. JOSEPH HARGREAVES" shall hear by post.

"MR. VINCENT BIRD" may send a letter addressed to our correspondent to us, and we will forward it.

"MR. JOHN PERRY."—We regret that we cannot give the information you require.

"A DISSENTIENT MEMBER OF THE PHARMACEUTICAL SOCIETY" is informed that we shall keep his suggestion in mind.

The Liverpool Mercury of April 12th has been received.

We have received the Liverpool Mercury of the 26th.

"J. G. K. B., A MEDICAL PRACTITIONER." Your article has been received. It is too late for insertion this month.

NOTICE.—*All Communications and Books for Review must be addressed* "To the Publisher of THE CHEMIST, 17, Surrey-street, Strand, London." *Communications must be pre-paid, and sent before the 15th of each month. Books for Review before the 10th.*

THE CHEMIST.

[NEW SERIES.]

I. CHEMISTRY.

FIFTH COMMUNICATION ON THE BATTERY.—SOME NEW EXPERIMENTS ON CHARCOAL.—LENGTHS OF THE VOLTAIC ARCH.*

BY M. C. DESPRETZ.

In the four communications which I have had the honor of making to the Academy, we have shown that all bodies are fusible and volatile (see THE CHEMIST, New Series, Nos. V., VI. and VII.).

The work which should naturally follow these communications, would be one in which would be given the order of the fusibility of bodies hitherto regarded as refractory, and even, if possible, the temperatures to which these fusions correspond. But it is scarcely prudent to work uninteruptedly on lights so vivid as that of the battery, the focus of annular lenses and even of the focus of the blow-pipe: we wished, until returning to the fusion of bodies, to devote our time to some investigations concerning the principal agent which we used in our former work. We now submit to the Academy some of the results which we have obtained on the voltaic arch.

We only ask permission to return to the charcoal on which we have also made a few experiments.

Although all those who have seen our first experiments have admitted the conclusions we have drawn from them, still we wish to strengthen former facts by new ones.

We compared a Bunsen's battery of 600 with a Munke's battery with broad elements. The latter battery, constructed by M. Ruhmkorff, was composed of three parts; each part contained 45 elements; the height of the elements was 35 centimetres, and the breadth 50 centimetres. The zinc was amalgamated; the distance from one plate to the next was about 3 millimetres.

This battery, arranged for quantity, that is to say, the three extremities terminated by the zinc being united by a large and thick plate of copper, and the three opposite extremities by a similar plate, had nearly the intensity of the Bunsen's battery of 600 elements, arranged in 24 series of 25 elements each, united pole to pole. A plate of charcoal, placed to receive each of the currents, in an inverse direction, was scarcely heated.

Each of these three parts was steeped in a trough partly filled with water, containing $\frac{1}{10}$ of nitric acid and $\frac{1}{10}$ of sulphuric acid. The energy of this battery was considerable, but of short duration: to such a point that, when each of the three parts was successively plunged into the trough, the energy of the first two was singularly weakened when the third was plunged in, which was easily recognised by the plate of charcoal traversed by the current: it became white hot at the moment of the immersion of the first part, and began to weaken when the second was plunged in. In order to profit by all the power of the instrument, each battery was placed on a plate over its trough; all the conductors were arranged; two persons were near each battery, two others held the conductors, another removed the plates at a suitable moment, and, finally, one directed the light. In a word, it requires ten people to make this experiment properly. There exist batteries of this kind in various establishments in Paris. They do not require a very laborious manipulation; they are formed of 50 or 60 elements

* *Comptes Rendus, No.* 13, April 1, 1850.

connected to one traversing wire, and are of not very considerable weight.

In the first experiment, a plate of retort charcoal, 1½ centimetre broad and 2 millimetres thick, in which a crucible was cut, was heated by the Munke's battery, arranged for quantity; the positive pole of the Bunsen's battery, arranged in six series of 100 each, was in communication with the plate; the negative pole was held over the crucible, into which fragments of sugar-candy charcoal had been put. The fire of the Bunsen's battery was thus directed on the crucible, whilst it was heated by the current of the Munke's battery. In an instant, the pieces of sugar charcoal were consumed, the crucible reduced to bent fragments, and the whole converted into graphite.

In another experiment, the two batteries were arranged for intensity. The Munke's battery had its 135 elements end to end; the Bunsen's battery was arranged in six series of 100. The two positive poles communicated with a plate of sugar-candy charcoal, 1 centimetre thick, 4 centimetres broad and 6 centimetres long. The charcoal rod, in which ended the two negative poles, was held over the plate. In a very few minutes a very deep cavity was produced in the plate, one part of which was covered with a thin layer of charcoal, fused and split, of more than one centimetre in diameter. This layer was of a blackish grey; gently rubbed with a strip of paper, it instantly became shining like the best graphite. M. Balard, Member of the Academy, M. Quatrefages, M. Germain Barruel, who are known to the Academy, and MM. Bary and Lefebvre, Professors of Physics in the Lyceums of Paris, unhesitatingly regarded the production of this layer as a new proof of the fusion of charcoal.

It may be regarded as singular that I always mention the persons who have seen my experiments on charcoal. It must first be observed that these are persons known to the Academy; it must also be borne in mind that I should be very awkwardly situated if, when the battery was dismounted, any doubt should be cast on the results which I several times obtained. I should be obliged to adjust the battery again, and if by any unforeseen circumstance I should fail in the repetition, I should then lose the most striking results of a work which has cost me much trouble, or I should have to wait until some conscientious natural philosopher might repeat my experiments. I do not wish to be in this position. I hope, however, that I shall repeat the experiments of the fusion and volatilisation of charcoal and of bodies called fixed or refractory, in the presence of Members of the Academy, who have been kind enough to manifest a desire to see them with their own eyes.

In a third experiment, made in the same manner, the plate of sugar charcoal was inadvertently touched with the rod of the negative pole. It was wished to remove it; it remained attached to the plate; it still adheres to it, although it is six weeks since the experiment was made, and although the rod is bent.

I will add some details before passing to the voltaïc arch.

The volatilisation by the direct passage of the current into an acicular rod of charcoal can succeed only when the battery is in the best state. I wished to show it to the class of the Sorbonne; it failed, either because the battery was not perfectly mounted (the nitric acid was at only 30°), or on account of derivations which might have been produced from the place where the battery was situated in the lecture room (the conductors traversed a very long course). Some days after, the battery having been worked and the nitric acid being weakened, I completely succeeded in presence of MM. Balard, Lefebvre and Bary; but I took care to arrange the experiment as if I wished to show the electric light *in vacuo*. The bell glass was almost instantaneously filled with the black vapor of charcoal, and the deposit adhered to the sides, which were broken as in all the analogous experiments in which we had volatilised charcoal in the same apparatus. As I have already said, this apparatus is too narrow. The dilatation of the glass is sudden, although the surface on which the vapor of charcoal was deposited was quite equivalent to two square decimetres.

I will here mention a fact which may be interesting. Acicular rods of retort charcoal are converted into graphite, in a few minutes, in an enameller's lamp. It is known, moreover, that this charcoal has been completely converted into graphite in the retorts in which it is produced. It is even probable that, after a sufficiently long time, the same transformation might be accomplished at a much lower temperature than that of the retorts in which lighting gas is made. This fact may be interesting in a geological point of view. I shall endeavor to verify it.

I now pass to the voltaïc arch.

Davy, Brande, Gassiot and Grove, in England; Bunsen and Casselmann, in Germany; Fizeau and Foucault, at Paris; De la Rive, at Geneva, and Matteucci, at Pisa, &c., have studied this subject.

When I publish the general detail of my

experiments, I shall endeavor to give a faithful and impartial history of all that has been done by my predecessors, in order to render to each that which is due to him. The present is a simple note; it is, indeed, only a portion of my work on the voltaic arch. I report measures taken in various arrangements of the battery, and in various directions and positions of the poles.

I here call the length of the arch the distance between the charcoal points at the moment of extinction, in consequence of the gradual separation of the charcoals. This is, we think, the real length; it should not include the portion of the flame which, in the case of charcoals placed vertically, sometimes covers the upper holder and the charcoal to the extent of 5 or 6 centimetres and even more.

We measure this distance to nearly a quarter of a millimetre, by means of a compass with fixed points, when the communication between the battery and the charcoal is interrupted; this approximation of a quarter of a millimetre is sufficient for this kind of experiment. We should attain, in general, greater accuracy by means of a micrometric vice and a divided stem; but, in the particular case of our experiments, we should not thus be free from the error occasioned by the wearing of the points and by the separation of some small pieces which are frequently thrown off at the moment of the arch being formed.

All the experiments were made at the ordinary pressure, in a square box of 80 centimetres each side. We at first, during the month of September last, made the experiment in the open air; but the arch being frequently broken by the currents of air, we enclosed the charcoals, to avoid this perturbing cause, in the box just mentioned. Two copper stems, of about one centimetre in diameter, and isolated, were attached to this box; one was fixed, the other was rendered moveable by means of a hook. When the direction of the charcoals is vertical, the upper stem is fixed; it neither rises nor descends; but it may turn in a socket, an essential arrangement for easily bringing the charcoal points in contact. This box is placed over vessels partly filled with mercury, into which the extremities of the thick conductors of the battery are plunged. The stems of the apparatus are made to communicate with these vessels by flexible bundles composed of 12 sheets of copper. The whole of the conductors do not represent the hundredth part of the resistance of the smallest battery (25 elements) which I employed in the experiments which form the subject of this note. I thus dispensed with making calculations of reduction.

At one of the faces of the box is a door which enables us to clean the charcoals; at another is a blue glass, through which the arch is examined at the time that the charcoals are repelled, by means of the isolated hook: no conductor directly touches the wood.

We placed the charcoals vertically and horizontally, parallel and perpendicular to the magnetic meridian.

Let us first take the case of the vertical charcoals. The electric light, at the moment when the arch is formed, is vivid, white and uniform. This light is weakened in proportion as the distance of the points increases, and when this distance reaches a certain number of millimetres, the arch or rather the luminous bundle appears composed of a whitish band which begins at the inferior point and which rises right into the superior point, of two less brilliant bands surrounding the central band, and finally of two outside bands of the same tint as the central band.

When a current of air deranges the arch which appears like a flame, it is the upper part which departs sometimes altogether from the charcoal; but a scarcely perceptible current must always remain which maintains the communication. It happens only too often that the arch is thus suddenly extinguished. We then have discordant numbers: these are rejected. It is especially when the arch approaches 2 centimetres that these anomalies are presented.

If the negative pole is below, we perceive on this pole a single point shining at the extremity and which seems sometimes to be displaced.

If, on the contrary, it is the positive pole, the lower point is more brilliant, and in a rather greater extent. This difference is also remarked after the extinction. With regard to the superior rod, as it is enveloped by the flame, it should be, and indeed it is, brilliant to a greater extent, whatever may be the direction of the current.

If the charcoals are placed horizontally, it is always the positive pole which is most brilliant, as has been remarked by different observers.

I do not occupy myself in this note with the question whether the light starts from the negative pole, a question which has been the subject of a recent work by Dr. Neef, and to which the Abbé Moigno again called the attention of the Academy at its last sitting. I confine myself to detailing the measures of the voltaic arch, which I have taken in different conditions and which appeared to me interesting.

The following are the results of measures taken in our experiments:—

The direction of the charcoals being supposed vertical, we remark:—

1st. The length of the arch increases more than proportionally to the number of the elements with a battery arranged end to end.

2nd. The increase is more rapid with small than with large arches.

Thus, the arch produced by 100 elements is almost quadruple that given by 50 elements; that of 200 is not three times that of 100; that of 600 is between seven and eight times that of 100.

The positive pole is here supposed to be above; in this case, we obtained arches which attained 2 decimetres with the battery of 600 elements arranged end to end.

3rd. If the pole be arranged in such a manner as to reunite the poles of the same name, or as it is called, arranged *for quantity*, the length of the arch increases less than proportionally to the number of batteries.

Thus, the arch of 100 elements being 25mm2, it is only 69mm2 for 600 elements arranged in six parallel series of 100, whilst the 600 elements placed end to end, that is to say, for intensity, gave an arch of 183mm5.

We added successively 25 elements to 25 elements, until 24 other similar batteries were united into one.

Our process does not enable us to measure the arch corresponding to 25 elements, which is extinguished as soon as it is formed.

With twice 25, the distance of the charcoal is still inappreciable, although the flame rises to the height of several centimetres on the upper charcoal.

With three times 25, the length of the arch is about 1 millimetre; with twenty-four times 25, this length amounts to 11mm5.

This experiment shows well the influence of the quantity on the length of the voltaïc arch, although it is the tension, especially, which determines it; for the same elements being united end to end, gave, at the same moment, an arch of 162 millimetres, that is to say, an arch 14 times the size.

4th. When the positive pole is below, the arch is not so long. A battery of 600 elements, united in six parallel series of 100, gives an arch of 74 millimetres if the positive pole is above, and only 56 millimetres if this pole is below.

5th. If the line of the charcoal is horizontal, the arch is necessarily more quickly broken. Here the battery arranged for quantity has the advantage; for example, six series of 100 elements each, arranged parallel to one another, give an arch of 40mm5; end to end, they give only an arch of 27mm6.

In this position of the charcoals, we have truly the arch. The light passes at once directly in a right line, then a dark vacuum is formed below and above the line of charcoals, and the light terminates at the inferior part by a circular arch. In proportion as the charcoals are more distant, this species of vault rises, and very soon takes the form of an acute angle: then the arch breaks or is on the point of breaking. During the experiment, the flame rises to a certain number of centimetres above the vault, according to the energy of the battery under the form of a cone having its summit above.

6th. In a plane perpendicular to the magnetic meridian, the arch is greater when the positive pole is to the east than when it is to the west. With 100 elements, the numbers are 13mm4 and 11mm35; with 200, arranged in two series of 100, these numbers became 20mm8 and 16mm5. Thus the terrestrial current, supposed from east to west, augments or diminishes the energy of the battery, according to the direction of the latter.

It is almost unnecessary to observe here that I have always followed the method of the corresponding experiments.

It is natural to place the charcoals in the direction of the meridian, after having placed them in a perpendicular plane. It is likewise natural to see the modification which the length or the form of the arch undergoes in vacuo, or in compressed air, or in any gas whatever with charcoal points, or with some metals, in operating in the air at the ordinary pressure with charcoal only. I have already made a certain number of these experiments; when I have sufficiently repeated them, I shall have the honor of presenting them to the Academy, if I consider the results worthy of its attention.

NOTICE OF THE ANALYSIS OF CERTAIN GOLD COLORED BRONZE ANTIQUITIES FOUND AT DOWRIS, NEAR PARSONSTOWN, KING'S COUNTY.*

BY MICHAEL DONOVAN, ESQ.

At a late meeting of the Royal Irish Academy, a communication was made by Thomas L. Cooke, Esq., of Parsonstown, relative to certain ancient bronze articles found at Dowris, in the King's County.

* Read before the Royal Irish Academy, Jan. 28th, 1850.

Some specimens, having been placed in my hands for analysis, by that gentleman, I deem it proper to lay before the Academy the results of my investigation. The articles given to me were part of a celt and a portion of a horn.

The golden hue of these ancient bronzes suggested to some persons the idea that they contained an admixture of zinc, an ingredient hitherto, I believe, never found to enter into their composition. Those bronzes in the British Museum that have been analysed consist only of copper and tin; and the Greek and Roman bronze coins are known to have been composed of the same metals. Bishop Watson, it is true, supposed that zinc was contained in a celt examined by him, because the metal when melted emitted a thick white smoke, accompanied by a blue flame, which are esteemed, he says, certain marks of zinc. This may possibly have been the case in Bishop Watson's particular specimen; but the celts examined by other chemists have proved destitute of zinc, so that its introduction into the ancient bronzes must have been very rare. Zinc would doubtless enhance the color and increase the malleability of the compound; but it would lessen its hardness, one of the chief qualities for which the metal was valued. Besides, the test of the presence of zinc assigned is equivocal. Dr. Pearson, on strongly heating portions of an ancient bronze, which he proved *not* to contain zinc, observed a fume, to a small amount, and he quotes the statements of certain assayers, who observed fumes to arise from charges of lead with silver, or lead with gold and silver, when much air was admitted. He also says, that "if much air be admitted to the alloy of copper with tin in fusion, a white smoke will sometimes be seen."

The specific gravity of the celt was 8·767, an indication of the presence of tin and of the absence of zinc; the following process was adopted to determine the question :—

A portion of the metal was dissolved in nitric acid with heat; a white powder separated, which being edulcorated, dried and mixed with borax and incinerated pitch, was exposed to the heat of a Russian furnace. The black mass obtained from the crucible examined with a strong magnifier, was found to contain thousands of metallic particles disseminated through it. By pulverising and washing this mass, I obtained a portion of the metal. Its solution in hydrochloric acid mixed with a small quantity of nitric acid afforded those appearances with solution of gold which indicate tin. The nitric solution of the celt, from which the tin had thus been separated, was subjected to the action of a bright plate of lead immersed in it: the whole of the copper was thus precipitated, as proved by the test of ammonia. The filtered liquor, now deprived of copper and tin, was mixed with a solution of sulphate of soda, and boiled down to a small bulk. The sulphate of lead being filtered off, solution of potassa was added, but no oxide of zinc appeared.

It was thus proved that the celt contained no zinc; other trials however showed that it contained a little lead. In order to determine the proportions of the constituent metals, the following method was adopted. I believe it differs in some respects from that hitherto practised, but previous trials convinced me that it is necessary in such cases.

100 grs. of celt metal were introduced into a tubulated retort, to which were attached a receiver and a series of three very small Woulfe's bottles, each of which contained a little liquid ammonia; the receiver was empty. 1½ oz. measure of pure nitric acid being poured through the tubulure of the retort, and a spirit lamp applied, a violent effervescence ensued; everything dissolved except the tin, which became peroxidised. Some acid and much nitrous gas came over, the latter of which passed through the ammonia. When the celt metal had all disappeared, the contents of the Woulfe's bottles were mixed with those of the receiver; the resulting liquor was of a light blue color, the nitrous gas having carried some copper over with it; this was reserved for a future process.

The solution of nitrate of copper was diluted with distilled water, and introduced into a precipitating glass, in order that the peroxide of tin should subside; after which the perfectly transparent solution of copper was decanted, and the peroxide of tin was digested with a little nitric acid, in order to dissolve away any minute particles of copper, which might escape solution by being entangled in the peroxide of tin. The peroxide was then well washed with distilled water; the collected washings were evaporated to one-eighth, and a minute quantity of peroxide of tin was thus recovered, which was added to the rest. By proper management the peroxide was drained to the last drop, dried in the capsule, collected with great care on glazed hot paper, and then transferred to a bulbed tube of Bohemian glass, without the smallest loss. The bulbed tube had been previously heated and counterpoised in the scale-pan of the balance. The bulb was

gradually heated until the peroxide was red-hot; the weight of the peroxide of tin was 16·678 grs., equivalent, according to the estimate of Berzelius, to 13·112 grs. of metallic tin. This mode of determining the quantity of peroxide of tin I found much better than filtering and burning the filter.

In order to discover the quantity of lead, pure sulphate of soda in excess, was added to the solution of nitrate of copper. No precipitate ensued. The whole was introduced into a retort, a receiver was attached and the acidulous water was distilled off. The process required the greatest vigilance, for the least increase of heat towards the end caused the liquor to sputter and shoot out particles in all directions, a circumstance which had compelled me the necessity of abandoning a former analysis of this celt. At length the nitrate of copper showed a tendency to solidify; the heat was then raised until nitrous gas began to appear. The heat being withdrawn, some distilled water was added, which dissolved the nitrate of copper, but left a small quantity of sulphate of lead. This being washed with frequent small portions of distilled water, was separated in the same manner as the peroxide of tin had been, and heated to a dull red. Before it had cooled entirely, it was ascertained to weigh 1·75 gr., which according to the estimate of Berzelius indicated 1·142 gr. of metallic lead.

The next step was to ascertain the quantity of copper. The washings of the sulphate of lead were added to the solution of nitrate of copper; the whole was distilled in a retort, with the same precautions as before, until the nitrate showed a tendency to solidify. At this period I connected the same series of Woulfe's bottles, still containing the ammonia, which had been used for condensing the nitrous vapor, and which also held a little copper dissolved. Through this ammonia the nitrous gas evolved from the nitrate of copper, now undergoing decomposition in the retort, was obliged to pass, previously to its emission into the atmosphere, in its passage transferring to the ammonia the chief part of the copper which it had carried over. The heat was then gradually raised, and continued until the nitrate of copper was converted into a black mass.

I have mentioned that the *chief part* of the volatilised copper was detained by the ammonia, but it was not entirely absorbed; for, at the latter end of the decomposition of the nitrate of copper, the flame of a spirit lamp, held in the fumes which escaped from the issue tube of the Woulfe's bottles, assumed a splendid green color. The loss in this way must be trivial.

The bottom of the retort which contained the black mass was now cut out by means of a red-hot tobacco pipe, and the black matter detached from the glass. But so obstinately did a very small portion adhere that it could only be removed by nitric acid; the nitrate thus formed was decomposed by heat, and the black matter was added to the main product.

In order to recover the copper which was contained in the Woulfe's bottles and receiver, the liquors were collected and distilled to a very small bulk. The distilled liquor was colorless, and therefore contained no copper. The residue, being transferred into a capsule, was decomposed by heat, and the very small quantity of black matter which resulted was added to the main product.

The total quantity of black matter was now heated red hot, by means of a Russian furnace, for about five minutes. Before it cooled, its weight was ascertained to be 106·767 grs., equivalent, according to the estimate of Berzelius, to 85·232 grs. of metallic copper.

In another analysis of the same celt, I confirmed the foregoing result by a different proceeding, which was as follows:—100 grs. of the metal having been dissolved in nitric acid, and freed from tin and lead as before, the solution of nitrate of copper was precipitated by an excess of pure potassa. By boiling the mixture, the peroxide of copper resulted, and this was boiled with repeated affusions of distilled water. The washings were evaporated to a small quantity, and thus a little more peroxide of copper was obtained. The whole product was filtered and dried. The filter was carefully burned on a saucer, the peroxide was heated red-hot for five minutes, and, after deducting the known weight of the ashes of the filter, the weight of the peroxide was ascertained to be 0·41 less than by the former method; but I rely more upon the former estimate.

Directed by some preliminary experiments on the celt metal, I dissolved 100 grs., in 2 oz. by measure of pure hydrochloric acid, mixed with one-eighth of pure nitric acid, over a lamp-heat. A black powder was separated, which, when dried and thrown on a plate of platinum, maintained at a red heat over a spirit-lamp, burned with the characteristic blue flame of sulphur, in the midst of which could be discovered a few sparkles of burning charcoal. The sulphur had not been dis-

covered in the former analysis, because the nitric acid being concentrated acidified it. The weight of this black powder was but 0·15 gr. Although I sought for traces of gold, under the supposition that the celt might be gilt, as some persons imagined, I could not obtain any distinct evidence of the presence of that metal.

I next proceeded to the analysis of the horn, and conducted it with the same care. It is unnecessary to say anything more on the subject than to state the result of the two analyses. The celt consisted of—

Copper	85·232
Tin	13·112
Lead	1·142
Sulphur and carbon	0·150
	99·636
Loss	0·364
	100·000

And the horn consisted of—

Copper	79·345
Tin	10·873
Lead	9·115
	99·333
Loss	0 667
	100 000

The loss in both cases may be accounted for by the escape of copper in the nitrous gas, as already mentioned, which it was not in my power to prevent. The proportion of lead in the celt is so small that advantage to the properties of the alloy could scarcely be derived from it, yet it is too great for us to suppose that the lead was a mere impurity of the copper. I believe antiquarians are not agreed with regard to the purpose to which celts were applied. Whatever it might be, the composition of the one examined by me was admirably calculated for fabricating weapons. The metal admitted of a fine polish and was then of a beautiful color. Its toughness was so great that it was capable of sustaining the fiercest encounter without fracture; whilst its edge, by the mere process of hammering, became so hard and keen that it would cut through not only flesh but bone. It was a matter of great interest to me to discover the skilful proportions of the constituent metals, which, in times of remote antiquity, our ancestors employed in order to combine beauty with utility; and both of these objects they appear to have fully accomplished.

In conclusion, I have to observe, that as the results of my analysis differ more or less from others which have been stated by chemists, I have been thus particular in detailing my methods. The difference of our results proves only the variety of proportions in which ancient manufacturers manipulated.

RESEARCHES ON CHROMIUM.*

BY M. J. LEFORT.

ON THE EQUIVALENT OF CHROMIUM.

It is well known that chemists differ concerning the equivalent of chromium. Without seeking to criticise in any particular manner all the salts employed by my predecessors, I may state that none have appeared to me to give such certain results as chromate of baryta. Indeed, this salt may always be obtained in a state of perfect neutrality, and sustains a very high temperature without being decomposed, even partially.

The chromate of baryta was weighed, then treated with hot nitric acid which dissolved it without residue. Sulphuric acid, added in slight excess to the liquor, formed sulphate of baryta, which was obtained perfectly white by washing several times with boiling water. The mean of ten analyses, which agreed very well with each other, was 60·10 of baryta per 100 of chrome. By calculating the equivalent of chromium from these data, we arrive at exactly the number 333·50—oxygen=100 (26·68—oxygen=8). It is on this equivalent that the following analyses were calculated.

HYDRATES OF SESQUIOXIDE OF CHROMIUM.

It is known that the salts of sesquioxide of chromium may exist under three different modifications; they may be green, violet-blue and red. These isomeric effects have served several chemists as the starting point of some very interesting observations, but with various conclusions. Some of these have been of opinion that the changes of color arise from a loss of water which the salts undergo when subjected to the action of heat. Others, at the head of whom stands the late illustrious Berzelius, think that, by the action of heat, the oxide of chromium undergoes a change in the grouping of the atoms which constitute its molecule.

When the action which the alkalies exert on the salts of chromium is closely examined, very decided differences are found, according to whether we operate with potassa or ammonia.

* *Comptes Rendus*, No. 14, 8 April, 1850.

When a green, violet-blue or red salt of chromium is treated by a solution of potassa or soda, the solution is speedily effected with an excess of alkali; it is green with the green and violet-blue salts, and violet-blue and afterwards green with the red modification. These solutions, left to themselves or submitted to the action of heat, deposit two hydrates of sesquioxide of different composition, although belonging to the green modification.

A. The first of these hydrates is obtained only when a solution of chromite of potassa is left to itself. The affinity which unites the acid and the base being very feeble, allows the oxide to deposit in the gelatinous state, and of a very fine green. By desiccation, it assumes the form of very hard and black pieces. In order to remove all its water of interposition, it may be very finely powdered and placed over sulphuric acid until it loses no more in weight; it is then presented under the form of a deep green powder. Its analysis gave the following results:—

	Weight of the hydrate.	Water disengaged.	per cent.
1....	0·566	0·2335	41·22
2....	2·765	1·1550	41·76

The theoretical composition gives, in 100 parts:—

	=100	=8		
Cr^2	667·00	53·36	}	58·91
O^3	300·00	24·00	}	
6HO	675·00	54·00		41·09
	1642·00	131·36		100·00

Exposed to the action of heat, this hydrate begins to give water towards 167° F.

B. The second is always prepared when a green, violet-blue or red salt of chromium is poured into a boiling solution of caustic potassa, or when a solution of chromite of potassa is heated. The oxide which results from it possesses all the physical characters of the foregoing; it contains, however, 1 equivalent less water, and gives it up only at 176° F. The following are the numbers which I have obtained from its analysis:—

	Weight of hydrate.	Water disengaged.	per cent.
1....	0·838	0·3085	36·81
2....	1·0275	0·3745	36·44

The theoretical composition gives, in 100 parts:—

	=100	=8		
Cr^2	667·00	53·36	}	63·23
O^3	300·00	24·00	}	
5HO	562·50	45·00		36 77
	1529·50	122·36		100·00

These two hydrates are certainly the same as those already analysed by M. Fremy, and in which he found 9 and 8 equivalents of water. But this chemist used a current of dry air for dishydrating them. Dried in this manner, were these oxides deprived of all their water of interposition? I think not. I submitted to a current of dry air, until the balance indicated no further loss, all the hydrates which form the subject of this Memoir. With all, I obtained the same results as when they were exposed in a close atmosphere, over caustic lime and concentrated sulphuric acid.

C. The preparation of the violet-blue modification presents more difficulties. It is necessary to pass by the red modification. It is also of this hydrate that we are about to speak.

When a solution of a green or violet-blue salt of chromium is poured into caustic ammonia, it is remarked that the hydrate which is precipitated takes, after some time, a red tint, at the same time that the supernatant liquid is colored of an amaranth red. M. Lœwel, who first observed this reaction, thought, with reason, that the oxide therein existed in a new isomeric state. In order to obtain the hydrate of this modification, the hydrate of the green modification may be left for some days in presence of ammonia, but this change is only slowly effected, and the product is never absolutely pure. The following is the method which I found most successful.

On pouring a concentrated solution of violet chrome alum into an excess of ammonia, the oxide which is precipitated speedily assumes a red color, and dissolves in the free ammonia. If, now, this solution be left to the air, or else over sulphuric acid, at the same time that the alkali is disengaged a violet powder is precipitated. All the oxide of chrome is thus precipitated, and the liquor contains only double sulphate of potassa and ammonia. The hydrate of the red modification is in very light powder; dissolved in the acids, it gives red salts which, by concentration in a dry atmosphere, return to the violet-blue modification. At the temperature of 167° F., it begins to lose water. At 248° F., the loss is complete; but, at the same time, it passes to the violet-blue modification, and then to the green. Its analysis gave:—

	Weight of the hydrate.	Water disengaged.	per cent.
1....	0·317	0·164	51·73
2....	0·791	0·405	51·20

Its theoretical composition, in 100 parts, is:—

	=100	=8	
Cr^2	667	53·36	48·86
O^3	300	24·00	
9HO	1012·50	81·00	51·14
	1979·50	158.36	100·00

I have said above that, in order to obtain the violet-blue oxide of chrome it is necessary to employ the oxide of the red modification. For that purpose, an amaranth solution of chrome alum in ammonia was heated on a sand bath to a temperature not exceeding 131° F. The ammonia, in volatilising, allows a pulverulent greenish-gray precipitate to deposit, which constitutes the hydrate of the violet-blue modification. Exposed to the action of heat, it begins to lose water towards 167° F. Analysed when it lost no more water over sulphuric acid, it gave the following numbers :—

	Weight of the hydrate.	Water dis-engaged.	per cent.
1....	0·5665	0·253	44 62
2....	0·8165	0·361	44·21

Its theoretical composition, in 100 parts, is :—

	=100	=8	
Cr^2	667	53·36	55·12
O^3	300	24·00	
7HO	787·50	56·00	44·88
	1754·50	133·36	100·00

In fact, the oxides of chromium of the green, violet-blue and red modifications form four perfectly definite hydrates which are thus represented :—

Cr^2O^3+5HO
Cr^2O^3+6HO
Cr^2O^3+7HO
Cr^2O^3+9HO

These oxides give, with the acids, salts which correspond to their modifications; but, as M. Lœwel has very well observed, all, with time, revert, owing to a molecular arrangement, to the violet-blue modification, which appears to be the normal state of the oxide in these different combinations.

ON SOME NEW COMBINATIONS OF AMMONIA WITH THE FERROCYANIDES, AND ESPECIALLY WITH THE FERRO-CYANIDE OF NICKEL.

BY SENOR A. REYNOSO.*

When an excess of ammonia is poured on recently precipitated and humid ferrocyanide of nickel, it immediately dissolves, changes color, and almost simultaneously produces a precipitate composed of a multitude of very fine needles and of a violet color. We have met with many difficulties in procuring this compound in a dry state and making the analysis of it, as it is extremely unstable, exposure to the air is sufficient to decompose it into ferrocyanide of nickel and ammonia which volatilises. It was almost evident that a current of dry air or of other gases would decompose it, and in fact, on passing a current of dry air over this salt, it decomposed and ferrocyanide of nickel remained in the tube.

Passing a current of dry ammoniacal gas through a tube containing a certain quantity of this salt did not dry it, although the experiment continued for three days.

In the following manner we succeeded in obtaining dry ammoniacal ferrocyanide of nickel: we prepared a very considerable quantity of this salt, and having washed it well with water containing ammonia, we left it exposed on a filter to the open air for two days; the part which was in contact with the air was completely decomposed; but in the middle of the filter we found the salt not decomposed in the form of very close needles, of a blue violet color. This compound, thus dried, attains more stability, exposure to the air no longer decomposes it; but, subjected to a temperature of 100 to 150°, it decomposes, parting with water and ammonia: the residue was not however ferrocyanide of nickel, because a still greater elevation of temperature disengaged ammonia and hydrocyanate of ammonia, and there remained pyrophoric carbonates of nickel and iron, which inflamed with a report and burned in the air like a fusee.

If, instead of submitting the dry salt to the action of heat, we boil the humid salt with water, it is decomposed into ferrocyanide of nickel, ammonia and water. The ferrocyanide of nickel thus obtained is perfectly pure; and this mode of preparing it is the only one which furnishes it free from cyanide of potassium; in fact, it is, so to speak, impossible to disembarrass it from ferrocyanide of potassium. When prepared by precipitating a salt of nickel by ferrocyanide of potassium, even after having been washed during several days with hot water, it leaves alkaline ashes. It is not necessary to boil it with water, at the ordinary temperature, the decomposition of the ammoniacal ferrocyanide of nickel is effected spontaneously, but it takes a longer time. The weak acids seize upon the ammonia without attacking the ferrocyanide of nickel thus set free; the concentrated acids decompose the ferrocyanide of nickel in the ordinary manner. Potassa disengages ammonia, producing a

* *Comptes Rendus*, No, 14, April 8, 1850.

precipitate of oxide of nickel and ferrocyanide of potassium.

Ammoniacal ferrocyanide of nickel is prepared, as already mentioned, by directly pouring ammonia on recently precipitated and humid ferrocyanide of nickel; it can also be prepared by putting ferrocyanide of potassium into a solution of nickel containing much ammonia, or by reacting with a solution of the salt of nickel on a mixture of ammonia and ferrocyanide of potassium. In all these cases the needles of the salt will be more beautiful according as they are slowly formed, that is to say, when there is a great deal of ammonia, and the solution is consequently very dilute.

The analysis of this salt leads to the formula

$$2NiCy, FeCy, 5NH^3, 4HO.$$

Bi-ammoniacal ferrocyanide of nickel: $2NiCy, FeCy, 2NH^3, HO.$

Pouring ferrocyanide of potassium into a solution of ammoniacal nitrate of nickel produces a greenish white precipitate, which, after being well dried is a very dark mass, becoming white by pulverisation. It bites the tongue and is quite insipid; this body is completely insoluble and unalterable in water. The weak acids act on it as on the previous salt, but it is less easily destroyed. Ammonia dissolves it and transforms it into quinque-ammoniacal ferrocyanide. Heat decomposes it, disengaging ammonia, and hydrocyanate of ammonia, and leaving a carbonate which burns in fusing.

This salt combines or rather mixes with ammoniacal ferrocyanide of copper, producing a precipitate of a beautiful peach blossom color; the best manner of obtaining this precipitate consists in precipitating a mixture of ammoniacal nitrate of nickel and ammoniacal nitrate of copper by ferrocyanide of potassium.

Bi-ammoniacal ferrid-cyanide of nickel.—Ferrid-cyanide of potassium poured into ammoniacal nitrate of nickel produces a precipitate of a fine yellow, soluble in an excess of ammonia, and of which the formula is

$$3NiCy, Fe^2Cy^3, 2NH^3, HO.$$

All the ferrocyanides and ferrid-cyanides of metals, the oxides of which are soluble in ammonia, are themselves soluble in ammonia. The alkaline solution of ferrid-cyanide of cobalt is of a very deep red color. We must however except the protoxides of manganese and iron, which are insoluble in ammonia; besides, these oxides are only soluble in ammonia by the aid of an ammoniacal salt.

The ferrocyanides and ferrid-cyanides of metals of which the oxides are soluble in potassa, are themselves soluble in potassa. It is thus, for example, that potassa poured into ferrocyanide of zinc, produces at first ferrocyanide of potassium, and oxide of zinc, which dissolves in an excess of potassa. If the potassa be poured carefully, while filtering, the liquor will only contain ferrocyanide of potassium, and the oxide of zinc will remain on the filter. With ferrocyanide of mercury, the reaction is very clear; this compound is white: when treated with potassa, ferrocyanide of potassium is produced, with yellow oxide of mercury insoluble in an excess of potassa.

ON THE THIONIC ACIDS.*

BY MM. M. J. PORDOS AND A. GÉLIS.

In the February number of these Annals (see *The Chemist*, New Series, No. VII., page 301), MM. Sobrero and Selmi published the results of some experiments made on the products of the decomposition of hydrosulphuric and sulphurous acids in water.

This reaction had already been studied successively by MM. Wackenroder and Lenoir, and these two chemists found the product to be pentathionic acid.

MM. Sobrero and Selmi inquired—Is this the only acid produced in these circumstances? They thought it interesting to experiment, although the answer might readily have been given without fresh investigations, and they found, in the liquors which they examined, independently of pentathionic acid, tetrathionic acid, hyposulphurous acid and sulphuric acid.

After having set forth these results, they add: "It would be important to be able to determine in what circumstances one or other of the acids mentioned is formed in preference; certainly the difference of the product should depend on the relative proportion of the two gases, and, moreover, on the concentration of the liquid in which they are decomposed, and on the temperature. We have no positive data in this respect?"

We think that these questions should not be put in the present state of science; for it is sufficient, for solving them, to call to mind one of the most important properties of pentathionic acid and the pentathionates, which we pointed out with the greatest care

* *Annales de Chimie et de Physique*, April, 1850.

in our fourth memoir on the acids of sulphur, presented to the Academy of Sciences, on the 2nd of November, 1847.*

From the facts published by us, at that date, it results that pentathionic acid, free or combined, is an exceedingly alterable body. The acids of the thionic series are so much the less stable as they contain more sulphur, and pentathionic acid, containing the most sulphur of any of the series, is the most easily decomposed.

An aqueous solution of pentathionic acid or of any pentathionate, can be preserved only with great trouble; almost as soon as formed, it loses its transparency, and very soon forms a deposit of sulphur, which gradually crystallises on the sides of the vessel. The first product of this decomposition, which may be represented by a simple formula,

S^5O^5, Mo=S^4O^5, MO+S, is tetrathionic acid; it was therefore easy for MM. Sobrero and Selmi to foresee that they would find this acid in the results of a reaction whose initial product is pentathionic acid.

But the decompositions do not stop there: tetrathionic acid in its turn becomes trithionic acid; and this fact cannot be doubted, for if, after having prepared a large quantity of solution of pentathionate of baryta, the liquors are fractioned so as to be able to analyse them several times, at different periods, it is remarked that the deposits which absolute alcohol forms in these liquors absorb so much the smaller quantities of chlorine, as a longer time elapses after their preparation; and if we compare the number of equivalents represented by the weight of the chlorine absorbed with the number of equivalents of sulphate of baryta furnished by the product of the calcination of the same quantity of salt, it is observed, as we have said, moreover, that, in the first few days, the crystals obtained absorb from 8 to 9 equivalents of chlorine; that, afterwards, the crystals obtained absorb only 7 equivalents; and that, finally, setting out from this point, the liquor, which until now had always given a yellow precipitate with nitrate of mercury, began to give, with that reagent, precipitates increasing in blackness, until it contains nothing but trithionate of baryta, which forms a black precipitate with nitrate of mercury, and every equivalent of which absorbs only 4 equivalents of chlorine.

The different thionic acids being all converted into sulphuric acid by chlorine, absorb, indeed, very different quantities of this body, as the following equations indicate:—

$S^5O^5+Cl^{10}+10(HO)=5(SO^3)+10(HCl)$
$S^4O^5+Cl^7+7(HO)=4(SO^3)+7(HCl)$
$S^3O^5+Cl^4+4(HO)=3(SO^3)+4(HCl)$.

It is therefore evident that the acid (S^3O^5) is met with, like the acid (S^4O^5), in the products of the decomposition of pentathionic acid, and, consequently, in the products of the reaction of sulphurous and hydrosulphuric acids in water; and if MM. Sobrero and Selmi have been unable to detect the presence of this acid, it is because they have always operated on recently prepared products.

As to the sulphuric and hyposulphurous acids, their formation is very easily explained. All the acids of the thionic series may undergo, independently of the alterations which we have just pointed out, an ultimate decomposition the products of which are sulphuric acid, sulphurous acid and sulphur in variable quantity according to the acid. The sulphuric acid found arises from this ultimate decomposition which is always exerted on a small portion of the products.

The sulphurous acid arising from the same cause is converted into sulphite at the moment of the saturation of the liquors, and this sulphite in its turn becomes a hyposulphite, combining with the sulphur, which always exists in great excess in these liquors.

We have thought it useful to give these explanations in order to prevent, as far as in us lies, the confusion of falling into error, in consequence of ill-interpreted results, in a subject which requires to be studied with care.

We will avail ourselves of this opportunity to point out, in conclusion, some reactions of the thionic acids which are connected, to a certain extent, with the foregoing alterations. We allude to the action of the alkalis, and of potassa, in particular, on the acids of sulphur with 5 equivalents of oxygen.

These acids seem to partake with a great number of alterable bodies, such as oxygenous water and the polysulphurets of hydrogen, the remarkable property, indicated by M. Theuard, of acquiring stability in presence of acids. Thus, when we treat with water the chlorides of sulphur, which give rise, in presence of that liquid, to pentathionic acid and sulphur, it is remarked that the decompositions of this acid and of its products proceed with much less rapidity if, instead of employing pure water, we take the precaution of first saturating this water with sulphurous acid, or of powerfully acidulating it with hydrochloric acid, which in no way changes the reactions. The

* *Annales de Chimie et de Physique*, 3rd Series, tome xxi.

alkalis in dilute solution, on the contrary, easily decompose these acids, with the exception of the dithionic acid of Gay-Lussac and Welter.

But it is a remarkable fact, and one which it was difficult to foresee *a priori*, that sulphuric acid is never found among the products of these decompositions.

When pentathionic acid and potassa are employed, the acid is converted entirely into hyposulphite of potassa, by a simple molecular change:—

$2(S^5O^5,PO)+3(PO)=5(S^2O^2,PO)$.

In operating on a tetrathionate, the hyposulphite obtained is mixed with sulphite of potassa in the proportion of 3 equivalents of the first to 2 of the second:—

$2(S^4O^5,PO)+3(PO)=2(SO^2,PO)+3(S^2,O^2,PO.)$

When M. Langlois' salt is used in the experiment, the quantity of sulphite is greater. The reaction gives 4 equivalents of sulphite to only 1 equivalent of hyposulphite:—

$2(S^3O^5,PO)+3(PO)=4(SO^2,PO)+S^2O^2PO$.

In these three reactions, the quantities of potassa reacting are the same. But the trithionate is decomposed more difficultly than the other two and requires longer boiling.

The dithionate is not decomposed by potassa in solution.

All these decompositions are remarkable and differ completely from those which the same acids undergo spontaneously or by the action of heat. The following is the analytical method by means of which we were enabled to prove the foregoing results.

In all cases, we operated on salts of baryta recently prepared and analysed by chlorine immediately before the experiment. Without this precaution, there would be a risk of submitting to the reaction altered products, and, in this case, we should obtain, as occurred to M. Kelsner, sulphurets and sulphates.

In each experiment 0·1 gr. of salt was treated with 4 or 5 grammes of hydrated potassa, dissolved in 50 grammes of water.

After having kept this mixture boiling for some time, and after having allowed the liquor to cool completely, sufficient acetate of zinc was added to saturate all the potassa.

In some experiments, the saturation was even directly effected with hydrochloric or acetic acid; but, in this case, the employment of an excess of acid was most carefully avoided.

The liquor thus saturated was treated by a solution of iodine of known strength; the oxide of zinc was then redissolved in dilute hydrochloric acid.

In the case in which the liquor contained no sulphite, no deposit was formed, and the weight of iodine absorbed indicated the quantity of hyposulphite which was formed.

When the liquor contained a sulphite, after the absorption of iodine and the addition of hydrochloric acid, a few drops of a salt of baryta were added, the precipitate of sulphate of baryta was collected, the weight of which indicated that of the sulphite, and subtracting from the total weight of the iodine absorbed the quantity of iodine required by the sulphurous acid found, the difference easily indicated the hyposulphurous acid contained in the mixture.

In all our experiments, the alkaline liquors treated by an acid remained transparent before the absorption of the iodine, although they might contain a salt of baryta in solution.

The experiment is readily and easily performed; however, the treatment with iodine should be slow when the liquor has been saturated with acetate of zinc, because the sulphite of zinc which is formed in this case is very sparingly soluble, and is precipitated at the bottom of the vessel, under the form of granular crystals which iodine attacks only with difficulty. It was this that made us sometimes employ the acid directly; but then it is necessary to thoroughly cool the liquors before saturation, in order to avoid loss of sulphurous acid.

The results contained in this Note, on the action of alkalis on the thionic acids, explain two facts which might have seemed contradictory: it will readily be understood how the chlorides of sulphur, which give, when treated by water, only acids with 5 equivalents of oxygen, furnish, on the contrary, salts with acids of the sulphuric series, when treated by alkaline solutions.

ON THE WATERY SECRETION OF THE LEAVES AND STEMS OF THE ICE-PLANT (MESEMBRYANTHEMUM CRYSTALLINUM, L.)*

BY DR. AUGUSTUS VÖLCKER, PROFESSOR OF CHEMISTRY IN THE ROYAL AGRICULTURAL COLLEGE, CIRENCESTER.

A FEW months ago, I had the pleasure of communicating to the Botanical Society of Edinburgh the results of an examination of the watery liquid in the ascidia

* Read before the Botanical Society of Edinburgh, Jan. 10, 1850; from *Phil. Mag.*, May, 1850.

of *Nepenthes destillatoria*. Those present at the meeting, as well as the readers of the Philosophical Magazine, will remember that, in opposition to the statements of most botanists who have directed their attention to the subject of the watery secretions of the leaves of plants, I found the liquid in the ascidia of Nepenthes to differ materially from pure water, inasmuch as it contained from 0·30 to nearly 1 per cent. of solid substances, partly organic, partly inorganic. I stated at that time my doubts as to the watery secretions of plants being nothing but pure water, and gave some reasons for this opinion; Prof. Balfour, with whom I discussed the subject, kindly furnished me with the means of investigating this point still further by favoring me with fresh specimens of the curious ice-plant (*mesembryanthemum crystallinum*), a plant which is remarkable on account of the gland-like vesicular eminences with which its leaves and stems are covered. The result of the examination of the fluid secreted by the leaves of this plant has fully confirmed the opinion expressed in regard to the watery secretions of plants; at all events, it has shown me that the secretion of the leaves of the Ice-plant is not merely pure water, but water containing several substances in solution. Though I was unable to determine quantitatively the composition of this secretion, on account of the small quantity of liquid at my command—a quantity insufficient even for a minute qualitative analysis—yet I had no difficulty in detecting the chief constituent parts of the fluid. The secretion I procured by lacerating the gland-like eminences with which the leaves are covered, with a needle, and collecting the fluid in a glass bottle. The fluid thus obtained was colorless and nearly clear, without smell, and possessing no distinct taste. Litmus-paper dipped in it was very slightly turned red, showing the presence of merely traces of a free acid or an acid salt. In order to free it entirely from any particles of epidermis which might accidentally have mingled with the liquid, I filtered it through white filtering paper. The fluid, passing through the filter slowly, was now perfectly clear. On heating to 212° F., white flakes were separated, which proved to be identical with vegetable albumen. They were collected in a filter, and the filtrate evaporated to dryness on a water-bath. During the evaporation the liquid turned yellow, particularly when evaporated to a small bulk, and left a brownish-colored, very hygroscopic residue, which redissolved in a small quantity of distilled water, leaving but a trace of a humus-like, dark-colored organic substance undissolved.

The chemical nature of the fluid from which the albumen had been separated was ascertained as far as possible by the following tests:—

Ammonia produced no change.

Carbonate of ammonia gave no precipitate.

Carbonate of soda, on boiling, gave a white precipitate.

Oxalate of ammonia produced no change.

Phosphate of soda and ammonia, added to the concentrated liquid, gave a crystalline white precipitate of phosphate of magnesia and ammonia.

Chloride of platinum, added to the concentrated liquid, after the removal of magnesia, produced a crystalline yellow precipitate.

The presence of soda was indicated by the yellow color given to the alcohol flame.

Lime-water produced a white precipitate.

Sulphate of lime likewise produced a white precipitate.

Chloride of barium gave a heavy white precipitate.

Nitrate of silver gave a white flaky precipitate, soluble in ammonia, but insoluble in nitric acid.

Acetate of lead produced a white precipitate.

Basic acetate of lead gave a voluminous white precipitate.

A portion of the water evaporated to dryness and heated to redness, left a white ash, which effervesced with acids, indicating the presence of carbonates, originated from organic acids present in the fluid.

The nature of the organic acids, which in all likelihood accompanied the oxalic acid, I could not determine from want of material. The presence of oxalic acid, however, is distinctly indicated by the above reactions. They likewise show the presence of chloride of sodium, potassa, sulphuric acid and magnesia.

In comparing this secretion of the leaves of the Ice-plant with the fluid in the ascidia of Nepenthes, we find a material difference in their respective compositions, as will be seen by the annexed table, which exhibits the composition of both fluids:—

Composition of the fluid in the ascidia of Nepenthes.

Organic matter, chiefly malic and a little citric acid.

Chloride of potassium.

Soda.

Lime.

Magnesia.

Composition of the watery secretion of

the leaves of the Mesembryanthemum crystallinum.

Organic matter, albumen, oxalic acid, &c.
Chloride of sodium.
Potassa.
Magnesia.
Sulphuric acid.

ON THE PRODUCTION OF SUGAR IN THE LIVING BODY.*

BY M. BERNARD.

In the vegetable kingdom, sugar is evidently formed by the organs of the plant. Does the same occur in the animal kingdom, or is the sugar found in the living body derived from the amylaceous and saccharine matters contained in their food? Such is the interesting question which M. Bernard, the discoverer of the function of the pancreas, endeavors to solve, in a memoir an analysis of which we now present to our readers.

As the food which animals take often contains more or less saccharine matter, it was natural to consider, that the sugar found in their blood or fluids was solely derived from this source, and such is the prevailing opinion at the present day. This idea, was, moreover, confirmed by the theory, that animals are incapable of creating any immediate principle, but merely destroy those which are furnished to them by the vegetable kingdom. Hence the power of generating sugar has been said not to exist in animals, who are supposed to be capable of destroying that principle, and nothing more. Experiment and physiology overthrow this doctrine.

The first series of experiments performed by M. Bernard relate to the conditions necessary for the formation of sugar. Animals were fed on substances containing the sugar, or a substance capable of being transformed into sugar; and this latter principle was accordingly found in the blood soon after the meal. But it was necessary to push the inquiry further. Other animals were, therefore, fed on flesh, or left fasting for a long time. They were then killed, and their blood equally contained sugar. This important fact once determined, it became necessary to ascertain whence was derived the sugar found in animals which had not taken a particle of saccharine or amylaceous food. The sugar, though found in the blood of the heart, was not, probably, fabricated in that organ? Where, then, was it made? A glandular apparatus of the abdomen was the most probable source, and after various unsuccessful attempts, which need not be noticed here, M. Bernard adopted the following method:—

A dog was fed on flesh and then stunned seven hours afterwards. Some blood was collected from the vena porta, some chyle from the thoracic duct, some blood from the heart, and, finally, some of the matters contained in the stomach and intestines; all these were carefully tested for sugar. It was found in some quantity in the blood of the heart; in much greater quantity in the blood of the vena porta. Not a trace could be discovered in the matters taken from the stomach and bowels.

These experiments, frequently repeated, always gave the same results, and the author was evidently on the track of his discovery. Whence comes the sugar in the vena porta, was the next point to be ascertained. A dog fed on flesh was rapidly killed, and all the veins coming from the principal organs of the abdomen, were quickly tied. No sugar could be found in the blood of the intestinal, gastric, pancreatic, or splenic veins; while the hepatic veins, on the contrary, contained large quantities. The tissue of the liver was now analysed, and sugar found in it: the tissues of the the other organs contained none.

The question was thus solved. The liver manufactures sugar. But it may be asked, How came it that sugar was found in the hepatic veins, since, if made by the liver, it should have been carried forward towards the heart by the supra-hepatic veins? The answer is simple. When the abdominal cavity is opened, all pressure is removed. The blood returns by reflux into the porta and hepatic veins. On placing a ligature over the porta, at the point where it enters the liver, no sugar is found in its blood, for no reflux then takes place.

It thus follows from the experiments now noticed, that the liver contains a considerable quantity of sugar; that this sugar is dissolved in the blood which traverses the liver, and that it is thence carried by the veins to the heart.

Having clearly established this important proposition, M. Bernard proceeds to describe at great length the various processes which he employed for the purpose of determining the presence of sugar in the liver and blood; but it is unnecessary to enter into these details, which are purely chemical. When a portion of the liver is triturated, then boiled for a few minutes in a small quantity of water, and filtered, we obtain an opaline fluid, having all the characters of a saccha-

* *Medical Times*, April 27, 1850.

rine solution. This latter turns brown when boiled with potassa; reduces the tartrate of potassa and copper, and ferments on the addition of a leaven, giving off carbonic acid, and the residue, when distilled, furnishes alcohol. M. Bernard has never been able to obtain the sugar in a crystallised state, on account of the great quantity of salts contained in the tissue of the liver. He thinks himself justified, however, in affirming, that it is not cane sugar, nor the sugar of milk, nor glucose, but the same principle as the sugar of diabetes.

Lastly, it may be asked, whence is derived the sugar contained in the liver? Here two suppositions are admissible. Either the sugar is formed by transformation of certain elements of the liver, or it arises from antecedent alimentation. The latter hypothesis is not adopted by M. Bernard. Sugar was found in the blood of dogs which had been fed on flesh for nineteen days. Again, section of the pneumogastric nerves suspends the formation of sugar in the liver, even in animals fed on carrots, &c. Its presence in that organ has been demonstrated at the fourth and fifth month of intra-uterine life.

CONCLUSIONS.

These may be given in M. Bernard's words:—

"Diabetic sugar exists normally and constantly in the blood of the heart, and in the liver of man and animals.

"This sugar is formed in the liver, and is not derived from saccharine or amylaceous nutriment.

"Its formation commences during intra-uterine life, and, consequently, before the ingestion of any food.

"The secretion of this saccharine matter appears to be connected with the pneumogastric nerves." The preceding facts overthrow, in the clearest manner, the generally admitted law, that animals are incapable of producing any immediate principle. We here see, that animals, like vegetables, can both create and destroy sugar. But the question is far from being exhausted. From what has been said, we are not to conclude that sugar will be found in the liver of the first subject taken from a dissecting-room. Many diseases eliminate it from that organ before death. It is well known that sugar disappears from the urine of diabetic patients some time previous to death. It also disappears from the liver. M. Bernard examined the livers of nineteen subjects, and in several there was no sugar, but his observations are not numerous enough to decide under what circumstances the sugar thus disappears. It is already certain, that lingering disease either diminishes the quantity in a remarkable manner, or removes it altogether.

The different classes of animals may also present differences in a normal state. There is a good deal in the livers of birds and mammalia; while fishes do not contain any sugar. Whence this difference? Perhaps, from the peculiar respiratory phenomena of these animals; for M. Bernard proposes demonstrating, in another memoir, that the energy of these phenomena is intimately connected with the formation of sugar in the liver.

ON ANHYDROUS NITRIC ACID.*

BY M. H. SAINTE-CLAIRE DEVILLE.

THE greater part of the attempts hitherto made to isolate anhydrous nitric acid, have brought over the very acid wished to be directly concentrated: the failure of these attempts and the readiness with which the mono-hydrated nitric acid spontaneously decomposes, had in some measure caused chemists to despair of depriving it of its equivalent of water, by putting it in contact with the most active hygrometrical substances. Another means still offered for obtaining anhydrous nitric acid, which was to disengage it by some known reaction of one of its anhydrous salts; but as the existence of anhydrous nitric acid appeared quite improbable, no one thought of this means, until M. Deville was accidentally led to imagine its possibility.

The process which he employs is founded on the decomposition by chlorine of an anhydrous salt, nitrate of silver, under certain conditions.

At the ordinary temperature, chlorine has no perceptible action on nitrate of silver; but on raising the heat to 203° F. for several minutes, an intensely red vapor developes itself, and continues to form even when the heat is removed. One of the products of this reaction is anhydrous nitric acid. This body is entirely destroyed at 203° F. but its production continues at only 122° or 140° F, if the decomposition of the nitrate of silver by the influence of chlorine has been begun by the momentary application of a more elevated temperature.

This fact being once established, it only remained to prepare an apparatus which would permit of the easy production of the nitric acid, and in sufficient quantity for examination.

* *Journal de Pharmacie et de Chimie*, April, 1850.

This is an extremely delicate operation; because, 1st, the body sought for ceases to exist at a temperature scarcely higher than that which is necessary to form it; 2nd, its production is very slow, and it possesses great tension, so that if an excess of chlorine is used in its preparation, this gas will carry off all the the acid vapor; 3rd, in consequence of the very facility with which it decomposes—the nitric acid is always accompanied by a liquid acid which dissolves a great deal of it, and which must therefore be separated as soon as it is condensed; 4th, finally, nitric acid attacks caoutchouc with such energy that all the pieces of the apparatus must necessarily be of glass and united by soldering in a lamp.

The chlorine intended for the decomposition of nitrate of silver, isco ntained in a large glass flask with a narrow neck, and of the capacity of 24 quarts, whence it is driven by a constant flow of sulphuric acid; the flask communicates with three *u* tubes intended for the purification and redessiccation of the chlorine. Further on is is another *u* tube larger than the former, containing dry nitrate of silver, and plunged into a copper vessel full of water, covered with some millimetres of oil to prevent evaporation, and heated by a spirit lamp furnished with a reservoir maintained at a constant degree of fulness. A fifth *u* tube, considerably shorter than the others, continues the apparatus: this tube is plunged into a refrigerating mixture and serves as a condenser: on its lowest side is a bulb, or little reservoir, into which the liquid products of the operation should run. Another tube which joins the others, leads the non-condensed gases into a Liebig's apparatus full of sulphuric acid, and they are finally introduced into a small tube full of alkalised water destined to retain the chlorine.

The apparatus being thus arranged the chlorine is passed slowly, and the water bath is heated rapidly to 203° F. The apparatus fills with a deep red vapor, and the temperature is permitted to fall to 131° or 140° F, at which it should remain stationary. The temperature in the condenser should be maintained at — 21°. The flow of sulphuric acid that displaces the chlorine is regulated in such a manner as to use 2·5 litres in twenty-four hours. The wick of the lamp is kept at right height, and the apparatus goes on without other care than watching the refrigerator. When the operation goes on well, all the chlorine is absorbed, and a volume of oxygen may be collected equal to half the chlorine used. The nitric acid is deposited in the form of perfectly limpid and regular crystals, more than a centimetre on each side, and which are comparable in brilliancy and transparency to the most beautiful quartz crystals. When the operation is finished, the ligatures are detached which unite the last two *u* tubes to the remainder of the apparatus, and the liquid condensed in the bulb of the condensing tube is poured out; the colored vapors are then driven off by means of a current of dry and pure carbonic acid. To collect the nitric acid, the end of the tube containing it is adapted to a small weighed bottle, terminated at one end by a slender stem, and at the other by a species of funnel. The bottle being plunged in a refrigerating mixture at — 21°, a fresh current of carbonic acid is forced into the apparatus which carries the acid in the condenser quickly into the cooled bottle, in which it is deposited in distinct and brilliant crystals. When it is judged suitable, the bottle is closed at its slender end, and at the middle of the narrow part of the funnel, by means of the flame of a blow-pipe.

Nitric acid crystals are right prisms with a rhombic base, or derived from it. These crystals fuse at 84° to 86° F, and the liquid boils at 113° to 122° F, giving a red vapor indicating partial decomposition.

Anhydrous nitric acid must be handled with care; its decomposition takes place with an explosion. M. Deville thinks that this decomposition is spontaneous, and is effected by time in whatever circumstance it may be placed. Water combines with it, producing heat, and without disengagement of gas.

There is no difficulty in its analysis; M. Deville decomposed it by means of metallic copper by the ordinary process.

The experiments which he has made to determine its composition and power of saturation, gave him the numbers suitable for anhydrous nitric acid, namely:—

Ni	14
O^5	40
	54

And for nitrate of baryta:—

Nitric acid	NiO^5	41·8
Baryta	BaO	58·2
		100·0

ON THE DECOMPOSITION OF SESQUICHLORIDE OF IRON BY BOILING.

BY JOSEPH DANSON. STUDENT IN THE LIVERPOOL COLLEGE OF CHEMISTRY.

DR. WILL mentions in his excellent work on Qualitative Analysis (page 20) that

"neutral solutions of sesquioxide of iron, or acid solutions in the presence of an alkaline acetate, are decomposed by boiling with separation of the hydrate of sesquioxide." I have been induced to examine the precipitate formed, and find it to consist of *pure* hydrate of the sesquioxide of iron

$$Fe^2Cl^3+3HO=Fe^2O^3+3HCl.$$

A solution of sesquichloride of iron was boiled for some time, when a reddish powder was deposited. This was collected on a filter and washed with water until the liquid percolating gave no residue when evaporated to dryness. It was soluble in strong nitric acid, slightly in weak, and insoluble in water. When dried at 100° C (212° F.), it gave the following by analysis:

·047 grms. gave ·032 grms. of sesquioxide of iron=68·08 p.c.

	Theory.	Found.
1 eq. sesquioxide of iron	80 68·97	68·08
4 ,, water.....	36 31·03	
	116 100·00	

Formula, Fe^2O^3+4Aq.

ON THE DECOMPOSITION OF IODIDE OF POTASSIUM BY METALLIC ACIDS AND BY POWDERED CHARCOAL.*

BY M. SCHŒNBEIN.

In the first part of his memoir, M. Schœnbein describes some experiments in which he decomposed iodide of potassium by different metallic acids. Antimonic, chromic, molybdic, tungstic, stannic, titanic, arsenic, and even phosphoric, acids, are decomposed by iodide of potassium, either with heat or otherwise. Iodine is set free, and a salt of potassa is formed. Chloride of iron, oxide of iron, the iron and cupreous salts have an analogous action on iodide of potassium. It appears to us unnecessary to mention all these reactions of which some may be new, but all of which are founded on known facts.

Bromide of potassium behaves like iodide.

The chlorides of potassium and sodium, on the contrary, are not decomposed in the same circumstances.

The chlorides of barium, strontium, calcium, and magnesium, and probably those of many other metals, lose chlorine when heated with bichromate of potassa.

M. Schœnbein concludes his communication by describing some very curious deoxdising reactions which may be effected in different solutions, by charcoal powder.

An aqueous solution of sesquichloride of iron is brought to the state of protochloride when agitated with pulverised charcoal. Calcined lamp black is more efficacious in making this reduction than ordinary wood charcoal; even coke will produce it.

Aqueous solutions of the sulphate, nitrate and acetate of iron, are reduced by charcoal in a similar manner to the sesquichloride. Red prussiate of potassa dissolved in water, is brought to the state of yellow prussiate when treated with the powder of ordinary charcoal.

Under the same circumstances, the bichloride and nitrate of mercury are brought back to the state of mercurial salts. These reactions are assuredly very curious; but their interest would be redoubled by some experiments to explain them. What part does the charcoal play in these reductions? This is a question which M. Schœnbein does not even raise. It is difficult to believe that carbonic acid is formed; and yet, if calcined lamp black is suitable for these experiments, as M. Schœnbein asserts, it is, on the other hand, impossible to attribute these reductions to the hydrogen that the charcoal may contain.

* *Poggendorf's Annalen*; vol. 78, p. 513.

ANALYSIS OF THE WATERS OF THE MEDITERRANEAN.*

BY M. UZIGLIO.

A knowledge of the composition of the water of the Ocean and of inland seas, is highly interesting in a geological point of view, owing to the importance of these great fluid masses in the history of the globe. It is no less interesting to the chemist and the manufacturer, who operate on the salts contained in these waters. M. Uziglio rightly conceived that it was necessary again to analyse the water of the Mediterranean, the chemists who preceded him not having estimated with sufficient correctness the proportions of potassa and soda held in solution.

The composition of the water of the Mediterranean cannot be compared to that of the Ocean, since it is circumscribed in a limited basin, and hence it is more concentrated. In fact, the saltness of the seas appears to be maintained by the salts supplied from the water of the continents, and by the soluble substances which mineral waters supply in their courses. Thus the water is generally most saline near the coasts. On the other hand, mineral waters,

* *L'Institut., Fevrier* 27, 1850.

and particularly salt springs, greatly resemble sea-water. According to M. Uziglio, the principal substances contained in the Mediterranean are sulphuric, hydrochloric, hydrobromic, and carbonic acids. M. M. Figuier and Mialhe, have also stated the presence of traces of phosphoric acid combined with magnesia. As to bases, Uziglio has observed potassa, soda, lime, magnesia, and oxide of iron, to which for the Ocean must be added oxide of manganese. The best known and the most abundant element of sea-water is chlorine; in fact, 100 grammes of the waters of the Mediterranean contain 2·0468 grs. of it, and only 0·0432 gr. of bromine, which almost constantly accompanies the chlorine; both occur combined with sodium and potassium.

The most important point in the researches of M. Uziglio into the composition of the water of the Mediterranean, is the proof of the quantity of potassa which it contains. According to his analysis, this quantity amounts to 0·0320 gr., or only 0·265 of potassium in 100 grammes. Notwithstanding the smallness of this quantity, M. Uziglio presumes, that before long the potassa extracted from the Ocean, or the Mediterranean, will replace the product of the lixiviation of wood-ashes, just as soda artificially extracted from sea-salt has been long and advantageously substituted for that obtained from marine plants. When the petrifaction of shells which occurs at present in the Ocean is considered, it excites no surprise that the proportion of lime should be double that of the potassa. In fact, 100 grammes of the water of the Mediterranean contain 0·623 gr. of lime; and the proportion contained in the Ocean, according to Figuier and Mialhe, is still larger. The carbonate exists in the Mediterranean in sufficient quantity to form considerable masses of shell-limestone analogous to those of the tertiary formation, and to be substituted for that which composed the shells in their fresh state. This new calcareous matter produces also true petrifactions, analogous to those of the geological era. One hundred grammes of the water of the Mediterranean contain 2·914 grs. of chloride of sodium, that is to say, nearly three per cent. The next most abundant salt is the chloride of magnesia, of which 100 grammes contain 0.3219 gr.; whilst the sulphate of magnesia amounts to 0·2477 gr., and the sulphate of lime to 0·1357 gr. The large quantity of sulphate of lime which the concentration of the water of the Mediterranean precipitates in the salt marshes, would induce the belief that this salt existed in larger quantity; and if analysis does not show a larger proportion, it must be remembered that the mother waters of the salt-works are frequently renewed. On this account it will be readily conceived, that after a certain time this salt may be deposited to a considerable extent.

Vegetables and animals contain considerable proportions of iodine, and yet the latest analyses do not indicate its existence either in the Ocean or the Mediterranean. It cannot, however, be inferred, that these beings have the power of forming it; it follows only, that the absorbent organs of vegetables and animals are more delicate and perfect than our best method of analysis. The quantity of bromine found in sea-water prevents the detection of iodine; the production of the blue color with starch may be effected or prevented at pleasure by repeatedly adding to a liquid an iodide or bromide; iodine cannot therefore be detected in sea-water while it contains bromine.

In a second memoir, M. Uziglio has examined the results of the evaporation of the water of the Mediterranean at different degrees of the areometer, and those of its analyses at different temperatures. He has given the result of his experiments on the deposits of salts comparatively with the thermometer and areometer; these tabulated results, however useful to the manufacturer, are not susceptible of analysis.

M. Uziglio has given a table (which is capable of being advantageously extended for the use of the manufacturer) of the different saline deposits obtained at different densities. The tables which precede it show that the progress of the continual evaporation of the water in the salt works, is identical until the density reaches 25°, and is pretty well maintained up to 30°; but beyond this, and when approaching 35°, the difference between day and night complicates the phenomena, so that very variable mixtures of common salt, sulphate of magnesia, and chloride of magnesium, are obtained.

The results of evaporation are still more variable above 35°. The mixtures of the salts deposited are subject to numerous differences in their composition, without the possibility of foreseeing the result of the precipitations: some contain from 0·5 to to 0·17 of their weight of potassa; it sometimes happens that this substance is found in deposits formed in solutions, whose density is only from 34° to 35°; these deposits are derived from variations in the composition of the waters.

RESEARCHES ON THE IDENTITY OF ANIMAL AND VEGETABLE NEUTRAL NITROGENOUS SUBSTANCES.*

BY MR. F. KELLER.

THE albumen, fibrin and caseïn which enter into the constitution of the tissues and liquids of the animal economy present, as is known, remarkable analogies of properties and relations of composition with certain neutral nitrogenous substances which are extracted from plants and which are known under the names of vegetable albumen, gluten and legumine. These analogies have led to a belief in their complete identity, and have given rise to a very important physiological proposition according to which animals would find in the plants on which they feed, the proximate principles of which their tissues are composed. Still, to demonstrate the identity of the nitrogenous matters derived from the animal and vegetable kingdoms, is a difficult matter; for every one knows that the properties of these substances, the atomic weight of which is very high, are not sufficiently well defined to admit of the application of the methods and the investigation of the characters which serve to distinguish substances possessing better defined properties.

Mr. Keller has endeavored to adduce some proofs in favor of this identity by examining the products of the oxidation of gluten, and by comparing them with those furnished by fibrine itself according to Guckelberger's observations.

20 pounds of fresh gluten were gradually decomposed by a mixture of sulphuric acid, water and peroxide of manganese. For that purpose, gluten was introduced into 2 pounds of sulphuric acid, so long as it dissolved without blackening the acid. Water in quantity insufficient for precipitating the gluten, and 2½ to 3 pounds of peroxide of manganese were then added. This mixture was distilled in large retorts, care being taken to direct the very volatile and very abundant products disengaged into well cooled receivers. These products possessed a very penetrating odor, exciting a flow of tears and cough. They reddened litmus, and were formed of a mixture of volatile acids and aldehydes.

To separate these substances, Mr. Keller neutralised the product of the distillation with lime, and distilled the liquid. The neutral and volatile substances were thus separated from the acids, and were concentrated by repeated distillations. The lime solution, freed from volatile products, was decomposed by carbonate of soda. The salts of soda of the volatile fatty acids which were separated by Liebig's method (see *The Chemist*, No. VIII., p. 339), were thus obtained. The author in this way isolated formic, acetic, metacetic, butyric, valerianic and benzoïc acids.

By means of fractionned distillations, Mr. Keller separated the different aldehydes which were contained in the neutral products of the distillation. These were the acetic, valerianic and benzoïc (essence of bitter almonds) aldehydes. In comparing these products of oxidation with those obtained when fibrine or caseïn is treated by sulphuric acid and peroxide of manganese, it is found that they are nearly the same, as the following table shows:—

PRODUCTS OF OXIDATION.

Of animal caseïn, fibrine, and albumen.		Of gluten.
Acetic aldehyde	$C^4H^4O^2$	Acetic aldehyde
Butyric ,,	$C^8H^8O^2$	
Formic acid	$C^2H^2O^4$	Formic acid
Acetic ,,	$C^4H^4O^4$	Acetic ,,
Metacetic ,,	$C^6H^6O^4$	Metacetic ,,
Butyric ,,	$C^8H^8O^4$	Butyric ,,
Valerianic ,,	$C^{10}H^{10}O^4$	Valerianic ,,
Caproïc ,,	$C^{12}H^{12}O^4$	
Benzoïc ,,	$C^{14}H^6O^4$	Benzoïc ,,
Oil of bitter almonds.....	$C^{14}H^6O^2$	Oil of bitter almonds.

Consequently, Mr. Keller's experiments prove that gluten undergoes, under the influence of sulphuric acid and peroxide of manganese, decompositions analogous to those which animal albuminoïd substances undergo; added to the other data which science possesses on this subject, these experiments corroborate the opinion which regards gluten as an albuminoïd substance.

* *Annalen der Chemie und Pharmacie.*

DETAIL OF SOME EXPERIMENTS ON THE GASES GENERATED IN A SEWER.*

BY MESSRS. MAURICE SCANLAN AND ALFRED ANDERSON.

THE experiments by the authors were made upon the sewer in Friar Street, Southwark.

The sewer was in a very foul state, being 5 feet from the floor to the roof, and containing between 3 and 4 feet of deposit, which evolved a gas of a most powerful and filthy odor. To collect it, the authors used a circular funnel of tin-plate, which was inverted in the sewage matter of the sewer

* *The Quarterly Journal of the Chemical Society*, April, 1850.

and there kept floating on the surface by a board; with the top of this funnel was connected a gutta percha delivering tube, from which the gas was obtained. The pressure of the gas was capable of overcoming that of 4 inches of water. The greatest amount collected in 24 hours amounted to 34 cubic inches, from an area of one square foot.

The chief circumstance of chemical interest connected with this subject, upon which very little has as yet been done, is the probable existence of the bisulphide of carbon in this sewer at the time of the experiments. Being, however, a very difficult substance to detect at any time, and more particularly so when mixed with so many other compounds, the observations as to its positive existence are not to be considered as conclusive. At times its peculiar odor was strongly developed. Alcohol, through which the gas had passed, acquired a peculiar odor, resembling that of onions. In distilling this solution, results were obtained, confirming, to a certain extent, the existence of sulphide of carbon.

The mixture of gas was found to consist of sulphuretted hydrogen, carburetted hydrogen, carbonic acid and phosphuretted hydrogen; of the two latter a considerable proportion. A few minutes' exposure to the gas was sufficient to produce headache and nausea. A quantitative examination of the gases was not made.

ON SOME NEW FACTS RELATIVE TO THE CHEMICAL PROPERTIES OF OXIDE OF CARBON GAS.*

BY M. P. LEBLANC.

In determining the oxygen in a lighting gas by ammoniacal chloride of copper, MM. Stas and Doyère, and I, discovered a fact which had not hitherto been noticed. The reagent in question dissolves a large quantity of oxide of carbon; it dissolves even olefiant gas.

I undertook the study of this property, and the following are the results which I have obtained.

When a current of oxide of carbon is passed into a solution of protochloride of copper in hydrochloric acid, the gas is absorbed in considerable quantity, and with a rapidity similar to that of the absorption of carbonic acid by potassa; but the temperature is comparatively only slightly raised.

The ammoniacal protochloride of copper, out of contact with the air, acts in the same manner, and the quantity of gas absorbed is the same with the same quantity of copper dissolved. This solution afterwards turns blue by contact with the air, and may again serve for absorbing oxygen.

The acid protochloride of carbon, saturated with oxide of carbon, may be diluted with water, even in great quantity, without precipitation of protochloride of copper as before the absorption, and without disengagement of gas. The addition of alcohol does not produce turbidness; ether appears to destroy the compound, at least partially. I have not hitherto been able to obtain in the solid state the compound expected from this reaction.

Boiling, and a *complete vacuum*, drive off the gas; nevertheless, I do not yet despair of being able to isolate the combination.

The fact of the absorption of oxide of carbon by protochloride of copper appears to be of the same order as the absorption of binoxide of nitrogen by the salts of protoxide of iron, inasmuch as the absorption seems to take place in definite proportions.

I used for this purpose a cupreous liquor of known strength, and determined either the volume or the weight of the oxide of carbon fixed, corresponding to a known quantity of copper. The numbers approximated to equal equivalents of copper and oxide of carbon.

The salts of iron and tin at the minimum do not act on oxide of carbon.

The various salts of protoxide of copper in solution in ammonia, absorb oxide of carbon like the protochloride of copper, the ammoniacal sulphite for example.

The employment of M. Doyère's ingenious apparatus, is truly serviceable in investigations of this kind.

These facts add, it seems to me, new interest to the chemical history of oxide of carbon. Independently of a new reagent for oxide of carbon and the analysis of gaseous mixtures, we have here a new argument in favor of the hypothesis set up some years ago by M. Dumas, according to the constitution and properties of chloroxycarbonic acid, and the presumed part acted by oxide of carbon in oxamide. In this point of view, oxide of carbon would act as a compound radical, similar, in certain respects, to cyanogen.

The absorption of oxide of carbon by potassium, forming a compound which contains the elements of oxide of carbon condensed, comes also in support of this point of view, and establishes one more analogy between oxide of carbon and cyanogen.

I shall resume this question in an early communication.

I have proved, moreover, that cyanogen

* *Comptes Rendus*, No. 16, April 22, 1850.

acts on the protochloride of copper which absorbs it, forming a deposit of a chrome yellow color, the color of which is rapidly modified in the air.

M. Doyère is studying these properties in the point of view of their employment in the analysis of gaseous mixture. He has ascertained that this employment is susceptible of great precision.

ON THE FIBRINE OF MUSCULAR FIBRE.*

BY PROFESSOR LIEBIG.

FINELY divided flesh being freed, by exhaustion with cold water and pressure, from the matters soluble in this menstruum, there is a white, tasteless residue, consisting of true muscular fibre, nerves and cellular tissue. Muscular fibre is, erroneously, usually considered identical with the fibrine of blood, probably because their physical properties are similar. The fibrine of blood being immersed in water containing one tenth of hydrochloric acid, soon swells into a gelatinous mass; in stronger acid, the jelly contracts nearly to its former size, and swells again in water like a sponge. This may be repeated several times without the liquid dissolving any perceptible quantity of the fibrine.

The greater proportion of the fibrine of muscular fibre, on the contrary, dissolves immediately and perfectly in the same circumstances, forming a liquid which the presence of fatty matters renders rather turbid, and which may be completely separated from the undissolved portions by filtration, although with difficulty. The solution occurs at ordinary temperatures, coagulates when neutralised into a thick, white, gelatinous paste, readily soluble in excess of alkalies; chloride of sodium and other saline solutions produce a coagulum in it, soluble in a large quantity of water.

Neutralising the hydrochloric acid of the fibrine of muscle produces a precipitate, soluble in lime water, which, when boiled, yields a coagulum similar to a dilute solution of albumen. If the precipitate has been boiled with water, it is insoluble in lime water. It is remarkable that this constituent of muscle, so readily soluble in dilute hydrochloric acid, exists in very various proportions in different animals: thus in poultry and oxen the muscular fibre is almost entirely soluble, whilst in sheep more than half, and in the calf far more than this proportion, remains undissolved. This insoluble residue is white and elastic, but softer and more gelatinous than the fibrine of blood swollen in slightly acidified water.

The composition of fibrine of muscle differs from that of blood especially in the amount of nitrogen contained in it; it approximates to that of albumen. The following analyses were made by Dr. Strecker.

Fibrine of the flesh of poultry, dissolved in hydrochloric acid, precipitated by ammonia, and dried at 248° F., I., II., III. and IV:

Fibrine of the flesh of the ox, V.

Fibrine of the flesh of sheep, VI., VII. and VIII.:—

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.
Carbon	.....	54 46	.....	.....	53·67	.....	.....	.....
Hydrogen	.....	7·28	.....	.....	7·27	.....	.....	.....
Nitrogen	.....	.....	15.84	.....	.....	.....	.....	16·26
Sulphur	.....	.....	.....	1 21	.....	1·02	1·11	.....
Oxygen	.....	.....	.....	.....	.....	.....	.....	.....
Ash	1·4	.....	.....	.....	.....	.....	.....	.....

The fibrine is merely a fractional portion of a per cent. in the blood; it appears to contain more nitrogen than the fibrine of muscle, which renders the notion of its serving to form the latter very problematical. Iron forms an important constituent of the fibrine of the blood, and it is never absent; although the ash left on its incineration being sometimes perfectly white, it has been supposed not to contain iron, whereas it contains a considerable amount.

When well washed blood fibrine is covered with water, and kept warm in a well stoppered vessel, putrefaction soon ensues. It is gradually disintegrated, assuming at the same time a deepish color, and in about three weeks is almost wholly dissolved into a slightly colored liquid, in which some black flakes are suspended, the color of which arises from sulphuret of iron; the latter are easily separated by filtration. This solution cannot be distinguished from solution of albumen; heat coagulates it forming a gelatinous mass having the properties and composition of albumen, as shown by the following analyses made, at my request, by Dr. Strecker:—

	I.	II.	III.	IV.	V.
Carbon	53·9				
Hydrogen	6·99				
Nitrogen	.....	15·58			
Sulphur	.....	.....	1·59	1·45	
Oxygen					
Ash	.....	.....	.....	.....	0·28

* *Annalen der Chemie und Pharmacie.*

This albumen is one of the most remarkable products of putrefaction. A very fetid volatile product is formed during the decomposition, with a very small quantity of free hydrogen. The liquid filtered from the albumen contains a small portion of some nitrogenous substance, not yet further examined.

ON THE POISONOUS GASES OF VAULTS AND CEMETERIES.*

A RECENT number of the *Annales d'Hygiène* contains some interesting information on this subject, which acquires additional importance from the state of the graveyard question in England.

It had been long remarked by persons employed about the Parisian cemeteries, that a very pernicious gas was generated in the temporary vaults in which bodies were deposited, and M. Pellieux was requested by the Inspector of Cemeteries to investigate the nature of this gas, and discover, if possible, the means of counteracting its deleterious influence. One vault in Montmartre was particularly mentioned as insalubrious to the workmen, and was examined with care. It was eighteen feet deep, and contained eleven places for coffins on each side; those enclosing bodies being hermetically walled up. On descending into the vault, nothing but a cadaveric smell was perceived; yet a candle was immediately extinguished, though the vault had been left open for twenty-four hours previously. A bird let down to the bottom of the vault was killed in a few seconds. The Inspector and M. Pellieux now made an attempt to enter the vault, but were unable to do so. One of the workmen, long accustomed to such employment, with great difficulty, collected enough of the gas to fill a quart balloon.

The symptoms produced by exposure to the emanations are generally as follows:—The respiration first becomes difficult and oppressed; the head heavy and the face injected. A peculiar feeling of dryness is now experienced in the mouth, and deglutition becomes difficult. An acrid, warm taste, which the grave-diggers compare to that of bad brown sugar, is felt in the mouth: in a word, the symptoms of asphyxia are prominent.

The effects of the gas were found to be produced in many other vaults which were examined; and, what is curious, were particularly violent in a vault of the 30th series, although it was quite new, and had never received a corpse.

The gas collected from the vaults of the cemetery of Montmartre, Pere-la-chaise, and Mont Parnasse was examined chemically by M. Pellieux, and found to consist almost entirely of carbonic acid gas. In many of the vaults, however, a very notable quantity of carbonate and hydrosulphate of ammonia was discovered. M. Pellieux is inclined to think, that other gases, likewise, will be found, and proposes to submit to a regular chemical analysis, not only the emanations from the vaults, but also the air of the various cemeteries. As to the cause of these emanations, the author considers that they may be attributed to three principal sources:—

1. The decomposition of animal matter gives rise, as is well known, to a considerable quantity of carbonic acid gas. The quantity of the latter contained in a vault will not be in proportion to the number of bodies contained, but rather to the rapidity of decomposition.

2. In the temporory and pauper graves the mass of dead bodies in permanent decomposition is a constant source of carbonic acid gas. Hence, under certain states of the atmosphere, this gas may perhaps flow down into the vaults, just as a fluid would do.

3. In addition to the above general causes, there is a special one which refers to some of the vaults examined. These had been excavated in ground which had served for pauper graves (*fosses communes*) many years ago. In ground of this kind, decomposition does not go on rapidly, and the author affirms that he has had occasion to see bodies buried in such ground as little decayed as if they they had been buried for a few months only, though the date of sepulture went back to twenty years.

With respect to the means of counteracting the effects of the noxious gases contained in vaults, the author proposes adding a double chimney to each for the purposes of ventilation; but the Board of Health long ago recommended a more simple process, viz., pumping in atmospheric air with a common fire engine.

From the above analysis it will be seen, that M. Pellieux treats this important question exclusively as a chemist. Every one is acquainted with the deleterious influence of carbonic acid gas, but there is no doubt that other gases or volatile substances are produced during decomposition of animal substances, and play a very important part in the production of disease. This fact was pointed out many years ago by Mr. G. A. Walker, who had no opportunity, however, of detecting the precise

* *Medical Times*, April 27, 1850.

chemical nature of the volatile substances alluded to.

M. Gaultier de Claubry also alludes to the probable agency of these emanations, in a note attached to the memoir of M. Pellieux. M. Gaultier notices, that the author has taken only one view of the subject, and engages him to give a wider range to his experiments. Although it may be difficult to discover the precise nature of the poisonous exhalation, much benefit must arise from a scientific examination. It is, at all events. certain, that the development of carbonic acid gas, which explains cases of asphixia and sudden death in vaults, will not account for many other important phenomena connected with emanations from decaying animal matter. The peculiar acrid and sugary taste mentioned by the workmen, does not arise from carbonic acid gas; nor is it from this gas that the exhalations from stagnant waters become so injurious to health. The insalubrity of crowded wards in hospitals, gaols, &c., is likewise well known, yet the proportion of carbonic acid gas is there increased by a very insignificant fraction only. This was pointed out long ago by a Commission which the French Government had named to ascertain the number of cubic feet of atmospheric air necessary for each individual in barracks and military hospitals. The Commission showed, that the air of apartments became insalubrious long before chemistry was able to detect any sensible change in the quantity of carbonic acid gas.

In the Report of the General Board of Health on Extramural Interment, we find some observations of Dr. Lewis on the gases of coffins. In all cases, Dr. Lewis found that the gases extinguished flame, and were themselves incombustible. They consisted apparently of nitrogen and carbonic acid, "holding putrescent animal matter in suspension." Occasionally ammonia was present.

ON THE EXISTENCE OF IODINE IN CERTAIN FRESH WATER PLANTS.

BY M. J. PERSONNE.*

During the vacation of last year, I brought from the country a small water-plant, the spongy odor of which had struck me. I wished to see whether to this characteristic of marine plants, would not correspond an analogous composition, as far as concerned the saline substances, and especially whether it would not contain some metallic iodide. This idea was realised, and Professor Bussy was a witness of the proof that there was iodine in this plant, gathered on a rivulet in Morvan, towards the confines of the departments of Nievre and Côte d'Or. M. Decaisne had the kindness to examine this acotyledon and recognised it as the *Jungermania pinguis* of Linnæus, or *Ancura pinguis* of Dumortier.

The bed of the river is completely granitic, and the neighbourhood has merely a slight covering of mould.

Although my experiments were made in October, I delayed publishing them, intending to take another opportunity of evaporating a considerable quantity of the water of this rivulet, and seeking iodine in the saline residue; but the communication made by M. Chatin at the sitting of the Academy on the 25th of last March, obliges me instantly to lay my own observations before it.

* *Comptes Rendus*, No. 16, 22 April, 1850.

CHLORIDE OF TIN AS A TEST FOR THE PRESENCE OF SUGAR IN CERTAIN LIQUIDS.*

BY M. MAUMENÉ.

The author points out a new use for this reagent for matters whose composition is analogous to that of sugar. The chloride of tin, he says, affords a certain means of detecting in white or light colored tissues the mixture of cotton or flax with wool and silk, the former threads, indeed, under the influence of the bichloride of tin and heat, become perfectly black, whilst the others retain their color.

* *Comptes Rendus*, No. 15, April 15, 1850.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

ON THE ALLOYS OF GOLD AND SILVER USED IN THE MANUFACTURE OF JEWELLERY, PLATE, &c., WITH AN EXPOSITION OF THE VARIOUS FRAUDS PRACTISED THEREIN.

BY WILLIAM GRIFFITHS, WORKING GOLDSMITH.

LETTER V.

To the Editors of The Chemist.

DEAR SIRS,—In your last number I gave the methods of working and finishing the 16 carat alloy of gold, technically called, "wet color gold."

The next inferior alloy used is the 15 carat; but as it is merely employed as a substitute for the former on account of its being cheaper, I shall content myself with a few remarks upon its composition. The methods adopted for working it are precisely the same as for the 16 carat alloy.

Formula for 15 carat gold troy weight:—

	oz.	dwts.	grs.	
Fine Gold.....	0	12	12	troy
Silver.....	0	2	12	,,
Copper.....	0	5	0	,,
	1	0	0	

The only difference between this and the 16 carat alloy is, that it is lighter and exhibits a larger surface for its weight as its quality is lower, and that it requires a longer time in the salts to produce a color. The same salts are used as in the other wet coloring processes already detailed; in fact, it is merely employed as a means of producing a piece of work of the same size and appearance at a less cost than if the 16 carat alloy was used. The solder is thus composed:—

	oz.	dwts.	grs.	
15 carat Gold....	0	1	0	troy
Silver	0	0	4	,,
Brass	0	0	2	,,
	0	1	6	

I may here mention that work for coloring cannot safely be made of a lower alloy than 15 carats, although some jewellers color as low as 14 carats, but the work made of so low a quality is never of so good a color as the other alloys, neither is it durable, the large proportion of the inferior metals present rendering the material so liable to be acted on by the coloring salts, that after one application of them, the work becomes so rotten as to render a repetition of the process certain destruction to it. But it is only for work merely made to *sell*, that this alloy is used: as there are always rogues to make where there are fools to buy, the ignorance of the retailer renders him a ready prey to the dishonest manufacturer, of which advantage the latter largely avails himself.

The next alloy I have to treat of is the 14 carat *bright* alloy. Its technical term in England is, "Chasing Gold;" in Scotland and Ireland it is called, "bright fine Gold." It is always finished by polishing its surface with rouge, and is not colored like the other alloys described.

Its formula is thus:—

	oz.	dwts.	grs.	
Fine Gold.....	0	11	16	troy
Silver.....	0	6	0	,,
Copper	0	2	8	,,
	1	0	0	

This compound of the metals is of a hard and tough nature; hence the purposes to which it is applied, viz.:—The stems of pins, spectacles, springs of various kinds; it was *formerly** used for chains, such as the "curb" pattern, seals, brooches, &c., and the principal articles of bright work in use, its peculiar hardness and durability rendering it most valuable where great tension was required in the wear of an article, it being nearly as tough as steel, and not requiring the troublesome processes of tempering, &c., which the latter metal does. The solder used for 14 carat gold is thus composed:—

	oz.	dwt.	grs.	
14 carat Gold.....	0	1	0	troy
Silver	0	0	6	,,
Brass.....	0	0	3	,,
	0	1	9	

* I will explain in a future letter why I make use of this term, and I shall show your readers the substitutes *at present* employed.

The processes of melting, working, and soldering the bright alloys of gold are performed in precisely the same way as in the colored alloys; the only difference being in the modes of finishing them, and the purposes to which they are applied. Each alloy is selected for the purpose which its peculiar compound will answer best and most advantageously.

The next alloy is the 12 carats: it is familiarly known by the name of "Jewellers' Gold." It is of a deep red color, is soft and ductile, and is thus composed:—

	oz.	dwts.	grs.	
Fine Gold.....	0	10	0	troy
Silver.....	0	2	16	,,
Copper.....	0	7	8	,,
	1	0	0	

Its capabilities for working are very great, and it is much employed by goldsmiths as a metal for general use; and as it is the first alloy I have given for which "silver solder" is used, I will now explain the use of the latter, as it is a most useful compound. Silver solder is composed of two parts fine silver, and one part brass; fused together it melts at a very low heat, and has the property of uniting two surfaces either of the same metal, or of different metals, in a very surprising way; it is an universal medium, as it can be used for attaching any one object to another if the two are composed of any metal or alloy of metals that will not fuse at a red heat. I have found that for electrical purposes it is exceedingly useful, as in case of a wire cast into a zinc bar for instance being broken, another piece of wire can be attached easily to the broken part, and the connection made as perfect as before; in fact, in all experiments where a perfect connection is of importance, I would recommend to your scientific readers, a little practice in the use of this most valuable method of obtaining the desired result. In making chemical apparatus, both as a matter of economy and of real utility, it presents a means of arriving at the end required superior to all other methods of connection, as any one of ordinary mechanical skill will be able not only to use it, but will find by following the directions I give, a great assistance in its adoption for a variety of purposes:—Take of fine silver 2 dwts., of yellow brass 1 dwt., then make a hole in a piece of charcoal the size of a shilling in diameter and about half an inch in depth, and as flat as possible at the bottom; then place the silver in the hole and apply a "reducing flame," with the blowpipe, until the silver is fused into a button, then, while in a state of fusion add the brass (previously well painted with a solution of borax to prevent the sublimation of the zinc) to the silver, then fuse together; while in a state of fusion place on the surface of the button the face of a hammer which will at once both flatten and cool it, then roll or hammer it out to the thickness of a sixpence, then anneal it and clean it in sulphuric acid pickle, and it may be cut into small pieces for the following use. I will suppose that two ends of a piece of wire are required to be united:—hammer the two ends a little upon an anvil so as to flatten them, then clean the two parts to be united with a scraper or file; tie them together with slight iron wire and paint the edges with a solution of borax rubbed on a slate with water to the consistence of cream; then lay a piece of the solder at each end of the junction, apply a red heat with the blowpipe; the solder fuses, and the union is perfect. In soldering wires to plantinum foil, if strong acids are not used, as, for instance, in making a voltameter, this process is very convenient in connecting wires to the negative elements of batteries; in fact, it will be found a most useful addition to the Laboratory, as the practical chemist will easily acquire the necessary skill after one or two trials, and the student will obtain a vast advantage by rendering his experiments certain where before they might have been doubtful, as we all know that in electrical experiments if any metallic oxide be present on the surface of any conducting medium, its power and efficacy are immediately neutralised, and too often no result is obtained where it was expected, so by this means a great deal of trouble might be saved by adopting a certain connection where only a partial one was obtained by twisting wires together, &c. I write not from theory, but from the result of long experience; and I know that one of the many difficulties the young electrician experiences in his studies, arises from the cause I have named, viz., imperfect connection.

Having now shown how useful the solder I allude to is for many purposes, I need only say, that it is the entire medium used by goldsmiths for uniting the different parts of their work when the quality is below 12 carats; that it is the solder used by silversmiths in uniting the pieces of their work, and that all the repairs of jewellery (except colored work), are performed by its agency to, at least lay claim for it to be regarded as one of the most useful compounds in metallic combination.

The next alloy is the 10 carat; this, like

the 15 carat alloy, is used as a substitute for a better material when either the cupidity of the manufacturer, or the low price paid by the retailer, prompts him to prefer quantity to quality. It is very soft, ductile, and easily worked, and is used for the manufacture of many articles of jewellery.

Its compound is thus:—

	oz.	dwts.	grs.	
Fine Gold.....	0	8	8	troy
Silver.....	0	3	20	,,
Copper.....	0	7	20	,,
	1	0	0	

The reason for our adopting the silver solder in the low alloys of gold is this, that the greater the proportion of the inferior metals present, the easier the alloy of gold fuses, so that we are obliged to employ a lower kind of solder as the alloy descends in quality; as brass when united with silver affords the readiest means of connecting the pieces of work without melting them, we use that solder in all alloys of gold from 12 carats down to 8 carats. I have alluded to the protecting power of the gold in Letter IV., so far as it extends to 8 carats, which is the lowest alloy that will perfectly resist the action of nitric acid, and only at that quality when combined in certain quantities. The formula I now give, resists the action of the acid more perfectly than any other compound of the same value:—

	oz.	dwt.	grs.	
Fine Gold.....	0	6	16	troy
Silver.....	0	8	21	,,
Copper.....	0	4	11	,,
	1	0	0	

This is the lowest legitimate alloy worked by goldsmiths, and I wish I could say that it was the lowest alloy sold under the name of gold; but in a future number I will detail the various compounds of which modern jewellery is made, the many ingenious methods adopted to veil the false under the cover (absolutely speaking) of the real metal, and the gross impositions daily practised upon credulous persons who cannot possibly have an opportunity of forming a judgment of the article they are purchasing, the apparent respectability of the establishment being no guarantee as to the genuineness of the goods, as the proprietor, from very ignorance, is just as liable to be imposed upon as his victim. I will now conclude by giving a rule for alloying gold.

RULE.—Multiply the quantity of gold to be reduced by the difference in its quality (in grains or carats), and the quality required; divide by the quality required; the quotient gives the amount of alloy to be added. The requisite proportions of each metal to be determined by the particular quartation of the individual alloy.

I remain, Dear Sirs,
Truly yours,
WM. GRIFFITHS.

Dublin.

PLAN FOR THE APPLICATION OF SEWAGE TO AGRICULTURAL PURPOSES.*

BY HIS ROYAL HIGHNESS PRINCE ALBERT.

HIS ROYAL HIGHNESS PRINCE ALBERT, as one of the Governors of the Society, transmitted to the Council, through Colonel the Hon. Charles Grey, a communication on turning the sewage of towns, at present the cause of disease and pestilence, into a source of national wealth, by its application to purposes of agriculture. Colonel Grey informed the Council that this important subject had, along with the general interest it had lately excited in the public mind, become a matter of interest and study to his Royal Highness Prince Albert, and that he was commanded by his Royal Highness to bring before the Council of the Society, for their consideration and inquiry, should they think the subject worthy of it, what had struck his Royal Highness as being a simple plan for effecting the object in view. Leaving it to more competent judges to decide whether the sewage should be used as a liquid manure, or solidified, upon which point his Royal Highness wished to give no opinion himself, he had confined his consideration to the latter mode of application, for two reasons; namely, that, in the solid form; 1. It could be more easily transported. 2. It could be obtained at the least possible expense. Colonel Grey then proceeded to describe the plan proposed by his Royal Highness, which was simply this: to form a tank, with a perforated false bottom, upon which a filtering medium should be laid; and to admit at one end the sewage into the tank, *below* the false bottom, when, according to the principle of water regaining its own level, the sewage liquid would rise through the filtering bed to its original level in the tank, and, provided the filtering medium had been of the proper nature and of sufficient thickness, it would be thus freed

*Communicated to the Royal Agricultural Society of England through Colonel the Hon. Charles Grey, at its meeting of the 24th April, 1850.

from all mechanical impurity, and would pass off into the drain, at the other end of the tank, as clean and clear as spring water. This simple and effective plan was illustrated by drawings, showing the vertical and horizontal sections of the tank, and by a neatly constructed model of its external form and internal arrangements. It was also clearly shown, by these sections, how the sewage matter could be let into the tank, or shut off, when necessary, in the simplest manner, by means of common valves; and with what facility such a filtering tank might be applied to every existing arrangement of sewers, without requiring any alteration in their structure. The filtering medium having abstracted from the sewage all extraneous matter, would, in all probability, become the richest manure, and could, at any time, by stopping the supply of sewage, be taken out by a common laborer with a shovel, and carted or shipped to any place thought most desirable. The solid matter, too, held in suspension by the sewage, would probably form a very rich deposit at the bottom of the tank, of a substance approaching in its qualities to guano, and could be extracted by removing the false bottom, which rested on arches or vertical supporters over the sewage below it in the tank, and could be easily made to lift up or take out for the purpose of such extraction. Two tanks might easily be constructed together, so that one might continue in operation while the other was being emptied. The experiment might be tried at any house-drain in town or country; in fact, his Royal Highness had himself tried the operation on a small scale with apparent success; and while he thus suggested an important and extensive application of the hydrostatical principle involved in the plan proposed, he wished to lay no claim to originality in the adoption of that well-known law of fluid bodies by which they make an effort, proportionate to their displacement, to regain their original equilibrium. On that principle was founded, as he was well aware, the upward-filtering apparatus used by the Thames water companies. His Royal Highness's great object was by the simplest possible means to attain a great end; to effect an essential sanitary improvement, and at the same time to create a new source of national wealth, by the very means employed for the removal of a deadly nuisance, and the conversion of decomposing matter, highly noxious to animal life, into the most powerful nutriment for vegetation. His Royal Highness, too, wished to offer no opinion on the details required to complete the plan proposed, or on the mode of carrying it out in the most effective manner. Supposing it to be right in principle, its advantages in an economical point of view could only, his Royal Highness conceived, be ascertained by practical experience; and it was on that account, that he wished to submit it to the consideration of the Agricultural Society, who might be better able to carry out the necessary experiments. It would remain to be decided what is chemically or mechanically the best, and what the cheapest substance for the filter; what the best and cheapest construction of the tank; how long the sewage will pass before the filter becomes choked; and how soon the filter could be sufficiently saturated to make it profitable as a manure. His Royal Highness had used as the filtering medium, the following substances:—

1. Charcoal: admitted to be the most perfect filtering substance for drinking water, retaining effectually extraneous matters, and well known for its singular powers of purification.

2. Gypsum (plaster of Paris, or sulphate of lime): recommended by agricultural chemists, for fixing ammonia and other volatile substances, by the decomposition to which it becomes subject, when exposed to the action of volatile alkali.

3. Clay: in its burnt state, would act mechanically as a filtering bed; and in its unburnt state, on account of its aluminous salts, have also the property, like gypsum, of fixing ammonia, or of decomposing the ammoniacal and other alkaline salts present in manure; and in either state would be cheaply procured.

All these substances, his Royal Highness thought, would in themselves be highly useful as manures, independently of the purpose they would subserve as agents for filtration, or of the additional amount of manuring matter they would receive from the sewage which they purified. His Royal Highness, however, in thus incidentally referring to the substances he had himself employed for the filtering medium, was well aware how many more of equal, if not superior, value would suggest themselves to others, who, like himself, felt an interest in effecting the important object proposed. As he had given no opinion on the general question of the liquid or solid application of manure, but had merely stated the grounds of preference, in a practical sense, of the solid form over the liquid for the purposes of the filtering operation under consideration, his Royal Highness entered into no discussion on the amount of manuring matter retained by the filter compared with the soluble matter that might pass through it

along with the water, and remain in that liquid in a soluble, colorless, and transparent form; nor of the value of such filtered water for agricultural purposes. He had confined his observations to the agricultural value of the filtering bed, and the rich deposit obtained in the purification of sewage for sanitary purposes.

After the general expression of the members, of the gratification it gave them, to find that questions so intimately connected with the welfare of the community and the objects of the Society, enjoyed so large a share of his Royal Highness Prince Albert's deep interest and enlightened attention, Lord PORTMAN informed the Council that the plan proposed by his Royal Highness was not any suggestion made to him by other parties, and which he had been induced to patronise; but that it was his Royal Highness's own plan, and the result of his own deliberate consideration on a subject that his Royal Highness regarded as of vital importance to the country. His Lordship thought the plan proposed the simplest and cheapest contrivance that he had seen for the purpose proposed in all cases where there was a sufficient fall of drain in the declivity of ground where it was employed. The communication with which they had been honored by his Royal Highness, was a great proof of the useful matters to which his Royal Highness was devoting his attention. His Lordship expressed the pleasure it would give him to institute experiments on the plan proposed by his Royal Highness, in localities well adapted for their trial, and to report the result to the Council.

Sir ROBERT PRICE and Colonel CHALLONER considered the principle most excellent. Colonel Challoner thought the only difficulty would be found in adjusting the filtering bed to a just proportion to the amount of liquid that would have to pass through it, in order that all the extraneous matter might be abstracted and retained. He regarded the first results of the trial already made to be confirmatory of Professor Way's views of the power of certain soils over manuring elements.

Professor WAY was much pleased to find Prince Albert turning his attention to subjects of so much interest as the one his Royal Highness had then brought under the consideration of the Council. He had himself attended much to the question of the sewage of London; and whether in the most fashionable squares or in the most squalid courts, the crying evil was alike felt and present to the inhabitants of this great city. The sewage was itself divisible into two portions—the soluble and the insoluble. The insoluble matter consisted of cells of vegetables and animal matter, of hair and other floating substance: the soluble portion contained ammonia and the salts of potassa and soda. The insoluble was retained by charcoal and clay. Clay, by burning, gradually lost its peculiar property of arresting ammonia: in its raw state it possessed twice the power in question. Burnt clay would however form a good mechanical material for the filling in of the filtering bed. He thought gypsum would not answer the purpose of arresting ammonia in a case like the present, where the solid matter only was intended to be obtained and employed as manure. The gypsum, being sulphate of lime, yields its sulphuric acid to the ammonia, and thus forms sulphate of ammonia, which, as a soluble salt, is at once dissolved and carried off by the clear filtered water, and is consequently not left behind in the filtering bed. Thus, unless the filtered water is also used for irrigating purposes, the ammonia is thus carried off and lost. He thought the plan proposed by his Royal Highness for obtaining the solid manuring matter of sewage, if employed in connexion with the application of liquid manure, would form a complete system, and secure all the advantages to be derived from such a source of manuring matter. He then concluded by some remarks on the application of liquid tank manure, and to the excellence of his Royal Highness's suggestion in reference to the solid matter of sewage.

The Duke of RICHMOND thought it desirable to ascertain how far charcoal, after its use as a chemical and mechanical agent, during the filtering operation, would prove of value as a manure; whether, during such action, it gave up its own substance to effect the changes produced, or became changed by such agency; or whether it simply retained the manuring matter, and again yielded it as a manure to the field. It would also, his Grace conceived, be as well to determine the value of the filtering bed in comparison with farm-yard manure.

Mr. SHAW enquired whether peat charcoal was recommended for use in this plan. Eight different experiments were at that time going on in different parts of the kingdom with such charcoal saturated with the best manuring matter.

The Duke of RICHMOND thought that Mr. Shaw probably meant charred peat, and in his opinion there was a wide difference between charred peat and peat charcoal, or charcoal of any kind. The Council then unanimously voted their best thanks

to His Royal Highness Prince Albert for the kindness with which his Royal Highness had honored them with this interesting communication on so important a subject.

ON THE ALIMENTARY REGIMEN OF THE BELGIAN MINERS.*

BY M. GASPARIN.

It is only by means of a long and serious examination that we learn the modifications which the social state of a country, its wealth, its manners, its traditions cause in the fate of its working population. The difficulty of understanding the details of these different conditions and the relations which they bear to each other, have given rise to the idea that it would suffice to examine one, and that the alimentary regimen would be conclusive with regard to the others. In fact, it has been said, men improve their food in proportion as they acquire ease of circumstances, and we might imagine that this improvement is proportionate to that very ease.

We should much mistake if we took the first appearance for a general rule. We know some countries in which the spirit of foresight, pushed to its greatest extent, degenerates into a sordid parsimony, which increases as wealth increases, and where the severest privations, even of food, appear nothing if they lead to fortune. Our mountaineers in the midland part of France show us striking examples of this; but the necessity of keeping up the muscular strength required for their labors, causes their economy to be shown more in the choice than in the quantity of nutritive substances which they consume.

One remarkable fact which I have observed on our Belgian frontier, shows us another kind of economy in regimen, and this is carried to the amount even of alimentary substances consumed. The mining population in the neighborhood of Charleroi has solved this problem; to nourish itself sufficiently for the preservation of health and of vigorous muscular strength with less than half the nutritive principles indicated by the observation of the rest of Europe. Before describing this regimen, I must ask permission from the Academy to recall some principles which I believe to be recognised by all men of science who have seriously considered the subject of alimentation.

The regimen of man is everywhere composed of substances which are found suitable to undergo the action of the digestive organs, and which are termed *aliments*; these invariably contain albuminous matters and ternary principles deprived of nitrogen. Both are more or less enveloped and defended by ligneous matters and cellulose, and associated with other adventitious principles, essential oils, salts and earthy matters.

These latter substances, forming greater or less obstacles to the digestive action, establish among these aliments a scale of value which is not in exact proportion to the amount of truly nutritive principles.

But in merely considering these in the different regimens of men, we see that their elements do preserve an unchanging proportion to each other; for example, in the food of the English workmen employed on the Rouen Railway, nitrogen was to carbon in the proportion of 100 to 1887, and in that of the Irish in their own country where the potato is the chief article of food, nitrogen is to carbon as 100 is to 3942. The amount of carbonaceous matters then varies materially, and has no limit but the capacity of the organs.

It is different with albuminous substances represented by nitrogen.

From enquiries made in many of our departments, it results that the amount of nitrogen does not vary more than from 20 to 26 grammes in the daily rations of grown-up men.

The fact which I have observed in Belgium, and which is the subject of this paper, is as follows. Analysis demonstrates that the regimen of the workmen in the neighborhood of Charleroi contains only 14·820 gr. of nitrogen, and, what distinguishes it from other regimen, is the habitual use of coffee taken with every meal. This regimen is as follows:—

On rising in the morning, the workman takes what he calls his coffee; this is a very weak infusion of coffee and chicory, in about equal proportions. This beverage, to which is added about a tenth part of milk, constitutes almost all the liquid portion of their food. Before going to his work, the miner takes a good pint of this coffee, and eats a thick slice of white bread and butter. He takes with him to the mine, some more slices of bread and butter and a tin bottle containing about a quart of coffee; he consumes these aliments during the day. On returning home in the evening, he eats some potatoes cooked with cabbage, or some other green vegetable; he concludes this repast with a slice of bread and butter and a cup of his coffee.

All the workmen examined during this inquiry have declared that they eat a loaf in two days. These loaves weigh about 4 lbs.; that is 2 lbs. or one kilogramme each

* *Comptes Rendus*, No. 14, April 8, 1850.

day. They eat meat only on Sundays and great holidays, and on those days they each drink about two quarts of beer. Their bread is always white and good, but there are very few operatives privileged to eat meat on a second day in the week; it is a very rare exception. The quantity of butter consumed amounts to about 2 ounces (60 grammes) each day. The quantity of coffee and chicory consumed each day is about 1 ounce (30·59 grs.) of each. The portion of potatoes and vegetables cooked together, eaten in the evening, is about 1½ lb. (750 grammes) at the utmost. The workman, during the week, drinks neither beer nor any other fermented liquor, his coffee is his only beverage.

Thus this regimen is reduced to 2 quarts of coffee; two-tenths of a quart of milk; 1 kilogramme of bread; a variable quantity of butter; 750 grammes of green vegetables; ½ kilogramme of meat in the week, or an average of 73 grammes for each day; 2 quarts of beer in the week, or an average of 286 grs. per day.

The loaf of the operatives of Charleroi may be likened in nutritive value to the 4 pound loaf in Paris, which contains 1·25 per cent of nitrogen.

The analyses of M. Payen show us that 100 grammes of ground coffee give an infusion containing 0·726 grs. nitrogen; 100 grs. of chicory powder, 0·574 grs. nitrogen.

Meat in its normal state, with its ordinary proportion of bone, gives 2·42 per cent. of nitrogen; milk, 0·57 per cent; green vegetables, 0·36 per cent.

Butter, but ill deprived of caseum when not very well made, still gives 0·64 per cent. of nitrogen.

According to these calculations we find the following numbers for the regimen of the Belgian miners:—

		Nitrogen.
2 quarts of coffee:—	Coffee... 30·59 grs...	0·222
	Chicory. 30·59 „ ..	0·176
	Milk..... ⅒ quart....	0·114
Bread, 1 kilogramme.....		12·500
Butter, 60 grammes.....		0·004
Green vegetables, 750 grammes..		0·037
Meat, 73 grammes.....		1·767
		14·820

The proportion of albuminoïd substances which enters into the ration of the Belgian miners is then reduced to 15 grs. instead 23. Now this nourishment is inferior even to that which is imposed as mortification on the most austere religious orders. I have studied and analysed the regimen of the monks of La Trappe at Aiguebelle (Drôme). Their pale complexions, their slow step, the trifling mechanical labor to which they are subjected, and which the laborers in the country only reckon as a fifth of theirs, prove that their alimentation is at its minimum considering their circumstances: now it contains 15 grs. of nitrogen and 402 grammes of carbon or hydrogen, reduced to 6 equivalents of carbon.

The food of our miners is also inferior to that of the prisoners in our central houses of detention, where the mechanical labor is almost none, and is reduced to light motions of the arms which require more attention and skill than strength. Their daily regimen contains 16·56 grs. of nitrogen and 475 grammes of carbon or of reduced hydrogen.

To this must be added, that the miner subjected to a regimen which we have described as apparently so poor, is a most energetic workman; that when the French miners, those of Anzin for example, who are much better fed, try to work the mines of Charleroi they are soon obliged to give it up, being unable to rival the Belgian laborer in the execution of his task.

It is to the coffee alone that is to be attributed the possibility of being contented on a regimen which would not support a child; and it is not as a nourishing substance that it acts here, for analysis shows that it contains but one thirty-fifth part of nutriment. Coffee, then, has other properties which are of great importance.

Does it satisfy the digestive functions? Does it cause a more complete assimilation of the aliments? Or rather does it not retard the mutation of the organs which do not then require so large a consumption of materials to repair or support them? According to this hypothesis, coffee would not nourish, but would prevent loss of substance.

Following out these ideas, I proposed to examine into the effect of coffee on the excretions, when I was told of the experiments on this point recently made by Böcker.* It resulted from these experiments that when the subjects of them took no coffee, they passed 1364·500 grammes of urine in the twenty-four hours, containing 22·275 grs. of urea, 0·578 of uric acid, and 1·201 of phosphoric acid; and that, when they took coffee, the quantity of urine rose to 1733·750 grs., containing 12·585 grs. of urea, 0·402 of uric acid, and 0·854 of phosphoric acid—(page 198). If further experiments confirm these results, it would be easy to explain the facts we have just mentioned.

We know, besides, how sober people are

* *Beitrage zur - Heilkunde.* Crefeld, 1849; vol. 1, page 188, *et seq.*

who drink much coffee. The prodigious abstinences of the caravans, the slightly nutritive regimen of the Arab nations, come with all the authority of long experience in support of the effects attributed to this beverage; and the distribution of coffee to our troops during their fatiguing marches in Algeria, are regarded by the officers as one of the best means of enabling them to support them.

Other substances must have analogous effects which it will be interesting to study; we may mention, among others, the use of alliaceous bulbs in the south of Europe. On the other hand, M. Barral has just brought to light that the use of sea-salt very considerably augments the proportion of urea and of uric acid in the urine, thus producing entirely contrary effects to those of coffee.*

The easy circumstances of the population accustomed to the coffee regimen does not admit of a doubt. The only poor in the country are those whom accidental wounds, too frequent in the mines, deprive of the power of working.

An old overlooker who perfectly knows the country, who has himself been a common workman and who furnished me with much information, told me that a man with a wife and six children can live on two francs a day without running into debt.

These researches may have very important consequences on the fate of populations, and should be seriously considered by chemists, medical men and economists. If it were proved, that without injury to health, or to the development and continuance of strength, the use of coffee enables a man to be content with a much less abundant nourishment, it would be less difficult to provide for times of scarcity, and the importance of extending the use of this beverage would be too clearly understood for it to be oppressed with a heavy duty, which would be a real tax on an object of general consumption.

REMARKS ON THE FOREGOING NOTE. BY M. MAGENDIE.

I BEG leave of our honorable confrère to say a few words on the interesting Note he has just read to us.

It is true that the alimentary substances which contain little or no nitrogen are not nutritrive; this fact I myself established in a memoir read to the Academy some years ago; but to conclude, as is now often done, that the proportion of nitrogen contained in an aliment gives exactly its nutritive power, is to greatly exceed the truth deduced from the experiments which have been made on this point of physiology.

Many highly nitrogenous substances are not nutritious. Animals die of inanition on eating considerable quantities of gelatine, albumen, &c. They perish in the same space of time as if they had been fed on water alone, as the numerous experiments of the Gelatine Commission demonstrated. Fibrine itself, the almost sole base of muscular flesh, is not nutritive before having undergone its mysterious conversion into muscles. Dogs which ate at pleasure several kilogrammes of fibrine of the blood per day, and which digest perfectly, die nevertheless, with all the symptoms of inanition, after a month of this very nitrogenous regimen. This same fibrine cooked in excellent meat broth, which supplied the savory and saline principles of flesh, given as exclusive nourishment to dogs, was eaten with great avidity by them, but did not nourish them; whilst dogs fed exclusively with gluten, were well nourished and for a long time.

Raw flesh nourishes perfectly and in very small quantity. Dried flesh nourishes much less. I have proved, by experiments, that it is necessary, to nourish a carnivorous animal, to give it in dry meat the same weight as of raw meat; here the disproportion of the nitrogen in the two aliments is enormous, since raw meat in drying often loses nine-tenths of its weight, retaining its nitrogen. Therefore, in these experiments, nine or ten times as much nitrogen was required for obtaining the same nutritive result.

Why this enormous difference between the nutritive properties of the same substance? This is a question well worthy of the study of new organic chemistry. Does the heat most frequently employed in the dessication, as is the case with ferments, destroy certain properties of muscular flesh?

In conclusion, I may add that everything connected with the theory of nutrition is still concealed by an impenetrable veil. We know little or nothing concerning this important and fundamental phenomenon. We are beginning to comprehend the various acts of digestion, thanks to the recent labors of physiologists, and especially of M. Bernard; but all that happens after the formation and absorption of the chyle, all that passes in the blood and in the connection with the organic tissues and fluids is still enveloped in the most complete obscurity.

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* *Statique Chimique des animaux*, page 442.

We must not, as is evident, calculate the nutritive qualities of an aliment from the proportion of nitrogen in its chemical elements.

ON THE CULTIVATION OF COCHINEAL IN ALGERIA.*

BY M. CAP.

DOUBTLESS we have nothing to teach the ordinary readers of the *Journal de Pharmacie et de Chimie* as to the natural history of cochineal. We will merely mention in a few words, that this valuable product, to which the art of dyeing owes the beautiful scarlet color, and which is exclusively used in the manufacture of carmine, is, when alive, a small insect of the order hemiptera and of the genus *coccus*, which gives both the kermes and lake. This insect, as is well known, is especially found on the cactus, especially on the Mexican cactus, which the Spaniards have named the cactus of Castille. This is the *cactus opuntia* of Linnæus, and the *opuntia cochinillifera* of Miller, with red flowers, to which succeed prickly fruits. Cochineal is found in commerce, under the form of a kind of hemispherical grain, of a reddish brown, of the size of hemp-seed; it is the dried body of the female of the *coccus cacti*.

The two sexes of the cochineal are very different in form and size. The male is very small, lively and agile; he is furnished with two wings, six legs, and two antennæ; whilst the female, much larger than he is, is round, heavy, without wings, and is fixed for life on the leaves of the cactus on which she is born. The male is an elegant small white fly, having at the inferior end of the body two long silky filaments. The female is globular, and resembles an almost shapeless shell or excrescence; its body is striped by scarcely perceptible rings, its six feet are concealed by a large abdomen full of a red matter, and between the two foremost feet is a salient point from whence proceeds a kind of proboscis which fixes it to its vegetable nurse.

During the first fifteen days after they are hatched, the young cochineals walk about the most tender leaves of the cactus, as though seeking a spot to which to attach themselves. This choice being once made, it is observed, that about a third of the insects become covered with a white powder in which the body is finally entirely enveloped, taking the form of a cocoon, of which one end continues open. The larva is then transformed into a chrysalis, and very shortly two filaments appear at the open extremity of the cocoon, which insensibly enlarge the opening, by which the insect finally issues backwards; these are the males. The other two-thirds are the females, who remain in their place without suffering change, and whose bodies increase daily in size, whilst the males fly around them or walk on their surface as upon a dome The females are attached to the vegetable on which after having given birth to a new generation, they must die, by an extremely thin sucker, from 6 to 8 millimetres long. This organ is the only point which unites the animal with the plant; if it is removed or broken, the insect falls and dies, for its obesity prevents it from remounting and reattaching itself to the vegetable.

The full-grown cochineal is nearly spherical and of the size of a pea. This is the time to gather the crop. The eggs, of an intense red, oval, and from 250 to 300 in number, are placed end to end like a necklace, which is capable of contracting itself and placing itself under the mother's sides: she envelopes them with a farinacious secretion to shelter them, detaches herself from the plant, and very shortly dies.

In rearing the young cochineals, great care must, above all, be taken to shelter them from the rain and wind. Simple mats laid over the cactus suffice to prevent the accidents which would be so prejudicial to the developement of the insect. When the time for the crop arrives, cloths are spread on the ground at the foot of the cactus plant, the leaves are cut off at the joint, and the cochineals are detached from them and collected in baskets; these baskets are then plunged into boiling water to kill the insects which are then spread on hurdles covered with cloth to dry, first in the sun, and then in the shade, in desiccators suitably aired.*

When commencing this culture, the first care should be to make a plantation of cactus *(une nopalerie)*. An open ground is chosen, that is without shade, but sheltered from the west winds; it is surrounded by a bamboo fence, as much to break the currents of wind as to defend the plantation from the attacks of animals. A cactus ground should not embrace more than a

* *Journal de Pharmacie et de Chimie*, April, 1850.

* This differs from the system followed in the Canary Islands. We have written to the principal exporters of cochineal in the Canary Islands for information on this subject, which we hope shortly to be able to lay before our readers.—*Eds. Chem.*

hectare; if more are wanted, they are multiplied without increasing the size of each cactus ground. The soil being well prepared, the plantation is made with slips, that is, with the leaves which are detached from the cactus and plunged half way up in the earth. The slips are planted at a distance of 30 centimetres in rows a metre and a half apart. At the end of two years, each will have four leaves added. At the commencement of the third year, in the month of April, they place, or rather according to the technical phrase, they *sow* the cochineal on the cactus. These are the mothers full of eggs, which have been kept during the winter on sheltered cactus plants. A certain number are placed in small cylindrical baskets, made of the leaves of the dwarf palm, which are placed sideways in the forked joints of the cactus. The insects quickly find their way through the interstices of the baskets, and spread themselves over the leaves. They are then distributed in groups, or nests, over the most fleshy and vigorous surfaces of the plant.

The crop of the cochineal sown in April is gathered in the course of June The mothers are then retained which are destined for the summer rearing, which commences at the end of May and finishes in September, and in this second crop the mothers are reserved which are intended for the winter rearing, that is for the spring reserve. In a very favorable season as many as three crops of cochineal may be obtained in one year.

We have said that the cochineal came originally from Mexico. It was at first supposed to be a vegetable product, and was long known by the name of *scarlet grain*. Lopez de Gomara, in 1525, was the first to give a description of the insect and of the vegetable which nourished it. Its use soon extended itself, and augmented more and more. In 1760, the commercial men of Marseilles alone bought to the amount of four millions of francs. Now we buy it from abroad for a far more considerable sum.

From the middle of the last century, many efforts have been made in Europe to transport thither the culture of the cochineal. In 1787, Thierry de Ménouville published a treatise on the culture of the cactus. He had imported some cactus covered with insects from Santo Domingo, but the revolution of Hayti did not permit him to turn his endeavor to profit: still this pursuit began to develope itself in Spain. In 1806, M. Sonceylier, surgeon in the navy, brought some live cochineal from Cadiz, which he sent to M. Robert, professor of botany at Toulon. In 1827, this naturalisation was attempted without much success in Corsica. In the same year it was introduced into the Canary Islands, and succeeded perfectly. The Spanish government, fully impressed with the value of this trade, forbade the exportation of the live insect under pain of death. However, in 1831, M. Simonnet, pharmaceutist at Algiers, had the courage to brave the perilous chances of the enterprise, and succeeded in importing some insects into Algeria from the kingdom of Valencia; but, obliged to make this attempt at his own risk and peril, and hindered by bad weather, he had the pain of seeing his efforts fruitless. Two years afterwards, Dr. Loze, surgeon in the navy, was more fortunate. Exposed to the same dangers as M. Simonnet, he brought several pots of cactus, each supporting thirty or forty healthy cochineal insects, and hastened to make his attempts at rearing them. About the end of 1834, he presented samples of his first crop to the Academy of Sciences, which were declared to be excellent. Being recalled in 1836, M. Loze was obliged to leave his cactus and his cochineal in the garden of Husein Dey, where they had much to endure. A short time after, M. Hardy, director of the central nursery, exerted himself to save the ruins; he could scarcely collect two or three pieces of cactus still bearing some mothers; it is from this poor commencement that M. Hardy has raised a collection which now promises splendid results, and we have been indebted for the principal details which we have given to a memoir recently published by that skilful agriculturist.

The climate and sun of Algeria, are, except in the mountainous regions, perfectly suited to the culture of the cochineal. In 1846, M. Guérin Méneville officially announced the increasing prosperity of the fine plantations in the experimental garden at the Hamma nursery. The samples of cochineal from Algeria, shown at the last *Exposition d'Industrie*, left nothing to be desired, and some cases of this product put into the market at Marseilles, rivalled, if not the first qualities from Mexico, at least the most highly esteemed produce of the Canary Islands. We will add, that this pursuit is one of the richest and most advantageous offered by agriculture: the cochineal insect is more easily reared than the silk-worm, and that it presents generally fewer chances of loss or failure.

We may judge of the progress of this culture by the following data, which we owe to the kindness of M. Guérin Méneville,

and which will shortly be the subject of a communication from him to the Academy of Sciences. In 1845, the culture of the cochineal, which was only commencing in Java, much encouraged by the Dutch government, already amounted to 45,000 pounds in the public establishments. In the Canaries, the first crop in 1831, consisted of only 8 pounds; in the following year, it was 120 pounds; in 1833, it had risen to 1,319; and in 1838, it was 18,800 pounds. Finally, we learn by a still more recent document, that, in 1849, the enormous quantity of 800,000 pounds was exported, of which the greater part was sent to France and England. This pursuit gives to the Canary Islands an importance which increases from year to year, besides the population and the revenues which they furnish to the treasury of Spain. The cochineal is become the principal object of exportation. At this time, the soils unfit for the culture of the vine or potatoe, are used for the cochineal, and converted into cactus plantations; such is the example offered to our colonies in Africa, and which promises a new source of wealth and prosperity to Algeria.

ABSTRACTS OF SPECIFICATIONS OF CHEMICAL PATENTS RECENTLY ENROLLED.*

SAMUEL BROWN OLIVER, of Deptford, Kent. *For certain improvements in dyeing materials.* (Communication from abroad.) Patent dated Nov. 10, 1849.

This invention consists in the manufacture and use of certain mixtures to be employed in dyeing woollen fabrics, or fabrics containing a mixture of wool.

The materials employed in the manufacture of these mixtures consist of the following acids: — Sulphuric, nitric, arsenious boracic, acetic, pyroligneous, oxalic, and tartaric acids, and of the following salts:— Chloride of sodium, or common salt, sal ammoniac, chloride of magnesium, chloride of potassuim, sulphate of potassa, sulphate of soda, sulphate of magnesia, oxalate of potassa, acetate of potassa, acetate of soda, nitrate of soda, nitrate of potassa, sulphate of zinc and borax.

The mixtures which the patentee prefers —who, at the same time does not confine himself to the exact proportions given, because, he states, variations in the proportions, or substitution of certain of the materials enumerated, may be made, so as to answer the purposes for which these mixtures are intended, are as follow:—

First Mixture.—100 parts of chloride of sodium; 300 parts of water; 10 parts of sulphuric acid; 3 parts of nitric acid; 1 part of arsenious acid.

Second Mixture.—100 parts of sulphate of soda or sulphate of potassa; 6 parts of sulphuric acid; 9 parts of nitric acid.

The two mixtures above mentioned—namely, No. 1 and No. 2, are not to be employed in grain colors, or in any other colors in which solutions of tin are present, but the mixtures following, namely. Nos. 3, 4, 5, 6, and 7, may be employed for all colors, including grain colors, or other colors in which solutions of tin are present.

Third Mixture.—100 parts of sulphate of potassa or sulphate of soda; 1 part of sulphuric acid; 3 parts of nitric acid; 6 parts of vinegar, or, in place of this, 2 parts of purified acetic acid.

Fourth Mixture.—100 parts of sulphate of soda or sulphate of potassa; 6 parts of sulphuric acid; 3 parts of tartaric acid (powdered).

Fifth Mixture.—100 parts of nitrate of potassa; 30, 40, 50, or 60 parts of sulphuric acid, according to the shade required; 1000 parts of sulphate of potassa or soda.

Sixth Mixture.—100 parts of the fifth mixture; 3 parts of tartaric acid (powdered); 10 parts of acetate of potassa.

Seventh Mixture.—100 parts of sulphate of potassa or sulphate of soda; 4 parts of nitric acid; 4 parts of acetic acid; 10 parts of tartaric acid (powdered).

The materials of which the before mentioned mixtures consist, are to be left in contact several days.

The mixtures before mentioned, or other analogous compounds, are to be prepared in vessels not easily acted on by the substances of which the compounds are composed, the substances being allowed to act on each other until decomposition and admixture are thoroughly effected. The compounds are, when required to be afterwards dried by natural or artificial means, reduced to powder in a mill or mortar, all which is said to be well understood by practical chemists.

The before mentioned mixtures may be employed in dyeing woollen fabrics, or fabrics in which a mixture of wool is present, and are to be used in dyeing in the same manner as cream of tartar or argol is now used, the same weight of the respective mixtures being taken as would have been taken of cream of tartar or argol. The mixtures are to be used along with the alu-

*Collected from *The Mechanics' Magazine.*

minous or other mordants in the ordinary operations of dyeing. For the dyeing of dark colors, the mixtures may be employed without the addition of other mordants, but for ordinary purposes, they are employed as a substitute for cream of tartar or argol.

Claim.—The use of such acids and salts when combined in the manner and for the purposes above described, or when any of them are made to substitute one another in such mixtures for like purposes.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

SKETCHES OF PHARMACEUTICAL SAVANS.

BY CORNELIUS CORKSCREW.

In introducing these critical Sketches we shall not make any parade of our good intentions, or commence with the hackneyed quotation, "Nothing extenuate, nor set down aught in malice!" For those who feel themselves aggrieved by our remarks will consider that we have belied our professions, and those who look with a less favorable eye than ourselves upon the subjects of our sketches, will believe that our pen has not been dipped sufficiently in gall, and that we have lacked the moral courage and the ability to give full force to our opinions.

To the discerning, it will be a matter of surprise that we should have ventured upon the task at all, considering the dearth of materials, except of the most common-place and contemptible kind, in consequence of the men whose characters we have undertaken to portray, having passed their lives in deserved obscurity until the birth of the Pharmaceutical Society.

From the tenacity with which these men have held to the prominent positions in this Society, their acts and characters have become public property, and as such they have rendered themselves amenable to public comment. Nevertheless, we shall refrain from following them into private life, except when it is absolutely necessary to elucidate their public conduct. For our object is not slander, or to pander to the vicious appetites of those who thirst for the secrets and foibles of domestic privacy; but to hold up as a beacon to the rising generation the truths, that, if men wish to achieve honor and reputation, their motives must be like Cæsar's wife, not only unsuspected, but above suspicion; and that intellectual labor and ability, and moral worth, are the only sure qualities which can permanently exalt men in public estimation.

1.—MR. PETER SQUIRE.

This gentleman enjoys the dignities of President of the Pharmaceutical Society, Chemist on Her Majesty's Establishment, and Flunkey-in-Chief to Sir James Clark. The first honor was a necessary consequence of the second, and the second was an appropriate reward for the third. Mr. Squire is, or *was*, one of the Examiners of the above Society. It is impossible to say which, with certainty, unless it be learned from private authority, as the recognised organ of the Society has cautiously abstained from publishing the names of the Examiners, although it continually brings into bold relief the names of the Council, Auditors, and Professors. This circumstance is a palpable proof, that, however audaciously these men take upon themselves the responsible duties of a scientific office, they endeavor to screen themselves from the public gaze and the scrutiny to which such publicity would expose them. They know full well that Mr. Examiner Nameless may be a very gifted individual, but that Mr. Examiner Squire might possibly be deemed a humbug. It is a well known fact, that imperfect as the education of the Pharmaceutical pupils is, it is far superior to that of those who sit in judgment on them.

The personal appearance of Mr. Squire is mean and unprepossessing: his visage is anxious and careworn. Of a fretful, jealous, and ambitious disposition, which detests anything like good fortune and talent in others, acerbity is as indelibly delineated in his countenance, as it tinctures his daily intercourse with his fellowmen. His very smile, when he attempts one, bears impress of its feline origin. In the petty world in which he moves, his character may be described as servile to his superiors, arrogant to his equals, and tyrannical to his inferiors. The power of his understanding being very circumscribed, without approaching to actual dulness, united with a restless ambition and a persevering industry, expends itself on a variety of petty objects. To a mind so constituted, every molehill which it throws up appears a mountain. It labors hard at conquering what seems to its vision

to be untold difficulties in the boundless sea of science, whereas its contending storm to men of more enlarged intellect, would be only a tempest in a teapot.

It cannot be a matter of surprise that a man possessing these intellectual and moral peculiarities, should be the most unpopular member of the Pharmaceutical Council, which the voting papers at the annual election will amply attest. Mr. Squire rejoices in occupying a high place in the estimation of the more penetrating members of the medical profession by having imitated Battley's Sedative in his Liq. Morph. Bimec.; by having discovered a wonder-working Extract of Taraxacum, which gives a milky solution with water; by having invented an ether inhaling apparatus with which Mr. Liston performed his first capital operation; and by having constructed a card-board box, with partitions to hold draughts—undying evidences of his mechanical and chemical skill.

To attempt a critical examination of the various papers published by Mr. Squire, would be flat, stale, and unprofitable, except as a warning to similar aspirants for scientific fame, who are wanting even in the elementary chemical education which the researches require on which such papers are based.

His paper on Expressed Juices, published in the Pharmaceutical Journal, vol. 1, page 94, written from jealousy of a rival, betrays an evidence of daring assertion, and of conclusions drawn without even the pretence of scientific data. The paper abounds in *ises* and *must-bes*. Now with due deference to Mr. Squire's prescient authority, we should have preferred one new fact to the five pages of *ises* and *must-bes*. For instance, we should have been glad to have known from what chemical analysis or other data he drew the conclusion, "that we cannot produce an extract with every facility of apparatus which shall fairly represent in power the bulk of the juice from which it was obtained" This assertion we pronounce to be mere fustian, and only introduced to give Mr. Squire a pretext for recommending his Expressed Juices. It would have been desirable to have been informed by what facts "he was persuaded that the juice is in the greatest perfection in the plant when more than half the flowers are fully blown," especially after the modest assurance that he differs from all the books published in reference to this matter. Mr. Squire finishes this paper by telling us that his method is not new. Did he think we should value his assertions and persuasions, because his laborious research extended from the year 1835 to 1841? Vain was his hope! For science allows not the length of a labor to plead an apology for the absence of the discovery of its hidden truths and laws. Deep and lasting must have been the satisfaction, when Mr. Squire discovered that infusion of roses contained tannin, and which tannin can be precipitated by gelatine. What solemn forebodings of future renown he must have felt when he announced these facts in his paper in the Journal, vol. 1, page 585. The only drawback to his satisfaction was, that these facts were previously known.

He has also favored the Pharmaceutical Society with an Essay on the Importance of Ventilation (see Journal, vol. 4, page 258), a title which is unfortunately a misnomer, for he dismisses the *importance* of the subject in about half a dozen lines. It ought to have been styled, "How Peter Squire ventilated his shop, and how pleased Peter was with his skill." In this paper he has favored his readers with a list of his great predecessors in this branch of scientific inquiry, doubtless thinking that history would place his name amongst them—although last—not least. In fact, so delighted was Jacob Bell with Mr. Squire's process, that he has immortalised it with a wood-cut.

In our anxiety to do justice to Mr. Squire, we have carefully read and re-read every one of his papers which profess to contain original matter, and to our utter chagrin we cannot find one iota which will justify his claim thereto. The temerity and the reliance on the credulity and ignorance of others must be great in a man who stands forward to expound his original investigations, in which, that which is true is not new, and that which is new is not true. To give one more example of the value of this assertion, we refer to his paper "On the Daphne tribe of Plants."—Phar. Jour., vol. 1, page 395 Herein he commences by stating that, "I propose to offer some remarks on this tribe of plants, with the result of a few experiments which I have made for the purpose of ascertaining the comparative efficacy of the above species;" and after indulging in a great many borrowed remarks, and reciting a few experiments not germane to the question at issue, he concludes by giving the best of all reasons why he should not have written the paper at all; namely, that it is not known on what principle the efficacy of this class of plants depends. Therefore it was utterly impossible without some such guide to make comparative calculations. But, perhaps, we are doing Mr. Squire an injustice

in saying he instituted no experiments to ascertain the comparative power of the various species; for he tells us, that he held his head over their boiling watery decoctions, and found a difference in the degree of the irritating qualities of the various species. We have seen the blind read by means of their fingers, and possibly Mr. Squire may be able to obtain analytical results by the medium of his sensitive pericranium. Verily, there are more things in heaven and in earth than are dreamt of in our philosophy.

Such, then, are the capabilities and the character of the man who has aspired to and has acquired the highest honors which the Pharmaceutist in this country can enjoy; viz., President of the Pharmaceutical Society, and Chemist on Her Majesty's Establishment. But let not his success prove a snare to deter the young aspirant for legitimate fame, by legitimate means, from ardently pursuing his more noble career: for, assuredly, there is a better time coming. There is a time coming, when there will be *a* Pharmaceutical Society which will judge righteously, and whose judgment will be respected concerning the really scientific man and the crafty impudent pretender. There is a time coming, when *a* Pharmaceutical Journal will denounce all unholy combinations between medical men and druggists; and will hold up to public infamy the Pharmaceutist who shall attempt to palm off as valuable and novel discoveries vile and senseless variations in the preparation or composition of remedial agents, however recommended by ignorant or interested authority. There is a time coming, when the man of genius and of probity, who scorns to resort to any such tricky means for ephemeral honor and gain, will receive at the hands of his cotemporaries a substantial reward. At present, he must look inwardly to his own soul for a recompence; and be comforted by the truth, that the man who obtains honors and rewards unmerited, in secret hates himself, which is the greatest purgatory of living mortals—a doom, terrible indeed, in comparison with the neglect, or even the hatred of the world.

HISTORY OF PHARMACY AMONG THE GREEKS AND ROMANS.

BY M. CAP.

"Multa renascentur quæ jam cecidere."

HIPPOCRATES very completely sums up the state of pharmacy among the Greeks, as Galen presents the most correct account of it among the Romans. It is therefore in the writings of these two masters of the science, that we must seek for the principal features of the history of our profession at periods when it was most advanced in ancient times.

Several lists of the most simple medicaments employed by Hippocrates have been published. Virey prepared, according to Daniel Leclerc, a catalogue amounting to about 300 substances.* K. Sprengel† gave a much more accurate flora of Hippocrates. Dr. James, in the preliminary discourse of his Dictionary of Medicine, presents a very long list of the simple and compound medicaments of which Hippocrates made use; a list likewise derived from the writings of Polybius, Thessalus, Dracon and others, who, as is known, united their works to those of their master, and Fourcroy‡ extracted from it some generalities interesting as regards the history of the art and its applications.

We notice among the medicines comprised in these several lists, a very great number of substances which are without very distinct action. Leeches are not among them; many drugs known in Galen's time are also omitted. Some preparations of copper were administered internally; they were acquainted with cinnamon, the ammomums, pepper, opium, and scammony were obtained from Egypt; butter was rare and little known; cantharides and other insects were employed internally; they were acquainted with the employment of fetid medicaments in nervous attacks and hysteria, and they seasoned food with the umbelliferæ and labiæ. The bile of several animals was used in collyria, but they understood by the word *collyrium*, as we shall see further on, a very different medicament from those which are now designated by the same name.

With Hippocrates, therapeutics were confounded to a certain extent with dietetics, for he says expressly,§ "that the meats and drinks which men use in the healthy state should also serve them when they are ill." He examines, indeed, most aliments in this double point of view, and his remarks on the qualities of the flesh of the dog, the horse and the ass, lead us to think that these meats were then in very general use.

Barley broth, diet and repose, were the first means which he used at the commence-

* *Journal de Pharmacie*, May, 1850.

* *Journal de Pharmacie*. t. I, p. 535.

† *Historia Rei herbariæ*, vol. I.

‡ *L'Art de connaître et d'Employer les Medicaments*: t. I.

§ *De Affectionibus*.

ment of acute diseases. He added to the bruised barley water a little vinegar, oil, salt, and sometimes dill or leek. The ordinary drink of the patients was composed of 8 parts of water to 1 of honey (hydromel, *mulsa* of the Latins.) Vinegar was sometimes added (oxymel).

The *cyceon* (mixture) was another beverage, made from rue, dill seeds, celery, coriander, wine, and wheat flower.

Hippocrates employed milk and whey, both as food and as medicines; not only the milk of the cow, but that of the goat, the mare, and that of the ass, which he ordered in very large quantity as a laxative.

Sudorifics were not then known. To induce perspiration, baths, fumigations, friction and heat were employed. The internal diuretics were sweet wine, garlic, the onion, the cucumber, the melon, the pumpkin, celery, cytisus, fennel, capillaire, solanum, oxymel, hydromel, *cantharides*, the legs and wings of which were removed, and which were mixed with honey and wine.

The narcotics, or rather the somniferous medicaments of Hippocrates, were the poppy (mecon or meconium), opium, the peplus (*Euphorbia peplus*), mandragora and hyosciamus; his febrifuges — absinthium, the lesser centaury, and some other indigenuous bitters. To excite vomiting, he employed asarum, white hellebore, and a plant which he called sesamoïdes, and which Dioscorides called hellebore of Anticyrus, or else he administered a large quantity of a laxative, and a decoction of lentils and hyssop with honey and vinegar.

His laxatives were the plant mercury, cabbage in decoction, whey, and salted cows or asses milk. He employed suppositories and lavements. The suppositories were composed of honey, juice of the plant mercury, salt, nitre, powder of colocynth, and of other irritating substances. They were sometimes round, like a ball, sometimes long. The lavements were composed of a decoction of beet leaves, with honey, oil, nitre, and other laxative substances. It is to be remarked, that the word clyster is applied only to the instrument and not to the preparation destined for the lavement.

EXTERNAL MEDICAMENTS.

The *fomentations* were divided into humid and dry fomentations. The first were partial or local baths, in warm water, or with decoctions of appropriate plants. To the diseased parts was also applied a leather bottle, a bladder, or any vessel whatever, filled with hot water; at other times a sponge steeped in a decoction of barley, srobe seeds or bran. The dry fermentations were made with salt, roasted millet, or aromatic substances which were enclosed in bags which were applied to the diseased part. For *fumigations*, steam, alone or charged with medicinal substances, was employed: for example, pieces of iron were made red hot and steeped into urine, and the vapor directed on to the part affected. They were also made with the smoke of resins, bitumens and aromatics. This means much resembled perfumes. For this latter purpose, tablets of flat form and round like a piece of money, and composed of odorous substances were burned.

The *gargarisms* which Hippocrates recommended in diseases of the mouth and quinsey, were composed of a decoction of origan, celery, mint, with a little nitre, honey and vinegar.

The oils and ointments were destined for anointing the body, softening tumors, and dressing wounds. The oils were simple or compound. The pure oil was olive oil. The compound oils, like those of roses and myrtle, were obtained by infusion. The susinum was prepared with the white lily and some aromatics; the narcissum had for its base the narcissus. The *nepotum*, the *metopium*, mentioned by Dioscorides, and the *mendosium*, spoken of by Galen, were still more complicated preparations of the same kind.

Hippocrates called *cerate* an ointment composed of oil and wax. Another cerate was prepared with goose fat, turpentine, resin of mastic, wax and oil of roses. When pitch was combined with the simple cerate to give it greater consistence, the *ceropissus* was obtained.

The cataplasms were composed of vegetable powders mixed with the juice of plants, and to which was sometimes added a small quantity of oil or ointment. In quinsey, a cataplasm of barley flour, with wine and oil was applied to the neck. The emollient cataplasms were composed of beet leaves boiled in water, to which were sometimes added olive, fig or oak leaves.

INTERNAL MEDICINES.

The liquid preparations administered internally comprised the decoctions, the infusions of vegetable substances with which were sometimes mixed powders, the juices of plants, the mixtures of wine, oil, honey, vinegar and other simple or compound liquids. The medicinal wines, prepared by infusion, were likewise employed.

The solid preparations were composed of inspissated juices, (extracts), gums, resins, various powders, the whole mixed with honey and other ingredients, and an appropriate form was given to them. It is, as is known, the point of departure of antidotes

and electuaries, which, in succeeding ages and to the present time, have occupied so large a place in pharmacy. The antidote of Hippocrates. mentioned by Actuarius, could not, however, be attributed to the physician of Cos.

The collyria were solid masses of the length and form of a finger, intended to be introduced into some cavity, like the suppositories and pessaries. The trochisci were of the same form and use as now. The eclegmas, were medicines of soft consistence, which were put on the tongue and swallowed slowly. Honey and various aromatic or mucilaginous powders, formed the basis of them. Finally, they were acquainted with the mellites, the oxymels and comfits, but not with the syrups, whose Arab name denotes a much more recent origin.

We find no details in the writings of the period of the operations by means of which all these products were obtained. The manipulations cannot have been very complicated. Digestion, infusion, decoction, the expression of juices, their inspissation by heat, and pulverisation, were those most frequently employed. Evaporation, calcination, fusion, and, perhaps, even sublimation, were known to the operators of the period. But beyond lixiviation, the crystallisation of salts, and the extraction of metals, they practised no reallv chemical operation, and had no idea of combinations of this nature.

Moreover, the healing art not having been divided into several branches, the art of preparing medicines was not distinct from that of prescribing them. Hippocrates himself prepared most of his medicinal agents, or had them prepared by servants whom he had instructed for the purpose, and this was the custom of all the physicians of his time. It is known that he carried his medicines with him, when he was called in by the Abderitans, for the cure of Democritus.

We shall find Pharmacy a little more advanced as an art, but also much more complicated in its products, during the ages which separate the period of Hippocrates from that of Galen.

To be continued.

FATAL EFFECT OF A BITE FROM A HUMAN BEING.*

DR. DUHR, of Coblentz, mentions the case of a police officer, whose thumb was bitten in taking a man into custody. The wound healed well, but after a week had elapsed, numbness and formication were felt in the thumb and index finger, with spasmodic twitches of the muscles. Next day, he was seized with violent convulsions and loss of consciousness for a short time. These symptoms diminished for about two months, but afterwards reappeared with increased intensity, accompanied by defective speech, want of sleep, and wandering: the patient soon died. The post mortem examination of the posterior portion of the left hemisphere of the brain was in a state of inflammatory softening, with congestion and diminution of consistence, both in the cerebellum, pons varolii, medulla oblongata, and the superior portion of the medulla spinalis.

* *Lancet.*

ON THE PURIFICATION AND PROPERTIES OF CHLOROFORM.*

BY WILLIAM GREGORY, M.D.,†
PROFESSOR OF CHEMISTRY IN THE UNIVERSITY OF EDINBURGH.

I. CHLOROFORM has been prepared from both alcohol and wood-spirit. The latter has been used for the sake of cheapness; but as it is a mixture of several liquids, all of which do not yield chloroform, it gives an impure product, in a proportion which varies much, but is always below that obtained from alcohol. There is therefore not only no advantage, but the contrary, in using wood-spirit, which is not, after all, much cheaper than alcohol.

II. But the chloroform from these two liquids, *when fully purified*, is quite identical in all its properties. Its odor, density, boiling-point and action on the system are in both cases exactly the same. That from alcohol is no doubt more easily purified than the other, but it also contains certain volatile impurities, which must be removed before it can be safely used. The peculiar oils which adhere to both kinds of chloroform are not identical, or at least not all identical, but they are of analogous constitution and properties.

* Read before the Royal Society of Edinburgh, March, 1850; *Monthly Journal of Medical Science*, May, 1850.

† Although I am alone responsible for the opinions contained in this paper, it is my duty to state, that all the experiments and observations mentioned in it have been made by me in concert with my able assistant, Mr. Alexander Kemp, of whose ingenuity and accuracy I have had constant opportunities of judging.

III. Soubeiran and Mialhe have examined these oils. They contain chlorine, have a disagreeable odor, and when inspired or smelt cause distressing headache and sickness. In the case of wood-spirit, some of its own impurities distil over unchanged, and are also found in the chloroform.

IV. It is well known that many persons, after the use of chloroform, have suffered from headache, nausea, and even vomiting, as I have more than once seen. Headache and nausea I have myself often experienced, when I have tried different specimens of chloroform, without taking so much as to produce the full effect.

V. Perfectly pure chloroform does not, so far as I have seen or experienced, produce these disagreeable effects. It is therefore highly probable that when they occur, as they do with some individuals, from the use of chloroform of more than the average goodness of quality, they depend on the presence of a trace of these poisonous oils.

VI. All good manufacturers of chloroform purify it by the action of sulphuric acid, which destroys the oils, whilst at the same time a part of the acid is reduced to sulphurous acid. The chloroform, to remove this, is then distilled with lime or carbonate of baryta, and is tolerably pure if the process be well conducted.

VII. But it is not quite pure, and contains a trace, more or less distinct, of the oils. I have found this to be the case with all the best chloroform made here up to 1849; and I have several times seen headache and sickness from the use of such chloroform, which was the best anywhere made. I must add, however, that the quantity of oils in the chloroform of the best Edinburgh manufacturers, although variable within certain limits, was always so small, that the product was fit for use, and only caused headache, etc., in a few peculiarly sensitive persons.

VIII. It was desirable to have a test for these impurities, as well as an easy and effectual mode of removing the last traces of them, especially as many sorts of chloroform not made here were far inferior in quality to that prepared in Edinburgh. One very delicate test is, that sulphuric acid which should be quite colorless, pure and of the full density of 1·840 at least, as it may be obtained by Mr. Kemp's process, lately read to the Royal Society, when agitated with the chloroform, becomes yellow or brown, from its action on the oils, which it chars and destroys. Any change of color is easily seen by contrast with the colorless chloroform which floats above. Pure chloroform gives no color to the acid. It is essential that the sulphuric acid be colorless and also of full density; for if colored, it is not easy to see a slight change in its color; and if below the proper density, that is, too weak, it is not much colored by a chloroform which will render dark brown the acid of proper strength.

IX. Another test, still more delicate, I find to be the odor of the oils. When chloroform is poured on the hand or on a handkerchief, it rapidly evaporates; but the oils, being less volatile, are left behind, and their odor, previously covered by the chloroform, is easily recognised. Until very lately no chloroform was sold, or indeed known, which would stand this test, or indeed the former.

X. Up to 1849, the best commercial chloroform had a specific gravity of 1·480, which was considered a guarantee of its purity; but it had been obtained by chemists of specific gravity 1·494, and even 1·497. I have found that chloroform of 1·480, when once more acted on by sulphuric acid, which destroys the oils and becomes brown, may be obtained, after removing the sulphurous acid, of specific gravity 1·500 at 60°. This I take to be the specific gravity of pure chloroform. Our best makers have lately, much to their credit, pushed the purification so far as to furnish chloroform even of this highest density, and also in other respects such as it ought to be.

XI. There are still, however, many makers in other places whose chloroform is not so pure; and I shall now describe the method which, with Mr. Kemp, I have employed for purifying, perfectly and easily, any commercial chloroform, except one remarkable specimen—a process which will enable any medical man to purify it for himself with the greatest facility.

XII. The chloroform, having been tested as above, and found more or less impure, is to be agitated with sulphuric acid (half its volume will be sufficient), and *allowed to remain in contact* with the acid, of course in a clean, dry, stoppered bottle, and with *occasional agitation* till the acid no longer becomes darker in color. As long as the action is incomplete, there will be seen, after rest, at the line of contact, a darker ring. When this no longer appears, the chloroform may be drawn off, and for greater security once more acted upon by a quarter of its volume of the acid, which should now remain colorless. It is now once more to be drawn off, and in a dry stoppered bottle mixed with a little powdered peroxide of manganese, with which it is gently agitated, and left in contact until the odor of sulphurous acid is entirely destroyed, and the

chloroform has acquired a mild, agreeable fruity odor. It has then only to be poured off into a proper phial. It will now leave no disagreeable odor when evaporated on the hand. [If the commercial chloroform, after having been *frequently well shaken*, and *left for some time in contact* with the acid, has given to it only a moderate tinge of color, it is probable that it may be completely purified by the first process. To ascertain this, test a fresh portion in a tube with fresh acid, shaking well and allowing it to stand some time. If it do not color the acid at all, then the whole chloroform has only to be finally purified by the oxide of manganese. If the acid become colored in the test-tube, it will be as well to act on the whole chloroform a second time, with fresh acid, till it stands the test. Mr. Kemp has observed, in repeating this process for me, the very curious fact, that as soon as the action is complete and the oily impurities are destroyed, but not sooner, the chloroform tested with the acid in a tube, exhibits a strongly convex surface downwards, where it rests on the pure acid, or, what is the same thing, the acid becomes concave at its upper surface. The small trace of impurity, not sufficient to affect the density of the chloroform, we have found to render the line of junction horizontal. It is probable that this may become a valuable test of the perfect purity of chloroform; but we shall not say more on this subject until we have thoroughly examined it.] This process requires no apparatus beyond a few stoppered bottles and a pipette, if we wish to draw off the whole chloroform without loss, although nearly the whole may be simply poured off. The use of the oxide of manganese is due to Mr. Kemp; and on the large scale the chloroform may be filtered through a cylinder full of it. In this final purification of commercial chloroform, no distillation is necessary. Indeed, no rectification is required at all, if it be well washed with water before using the acid.

XIII. It may be considered as certain, that the use of chloroform thus purified will very rarely, if ever, cause the disagreeable effects above noticed.* As to more serious bad results from the use of chloroform, so often spoken of elsewhere, it is enough to state that a large proportion of the cases must be attributed to the use of a liquid so impure as hardly to deserve the name of chloroform at all.

Postcript.—Since writing the above, my attention has been called to a paper by Dr. Wilson, on the specific gravity of chloroform, which he was not able to obtain higher than 1·498. I have therefore to add, that every specimen, whether of specific gravity 1·480, 1·490, or 1·4.97, which I purified as above, acquired the same density of 1·500, as ascertained by the use of a very delicate and accurate bead (made by Lovi) which sank at 60°·5 and rose at 59°·5; and also by three successive weighings, with a very delicate balance. It will also be seen, that three commercial specimens had this density; I could detect no foreign matter in my chloroform; and besides, every foreign matter that is likely to occur *lowers* the density. I have no doubt Dr. Wilson's specimens would have colored the acid, and left odor on the hand.

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* Dr. Simpson informs me, that the purest chloroform he has used not unfrequently causes vomiting. On further inquiries, I find that this occurs when it is administered after a full meal. This can be easily avoided, and must not be confounded with the headache, nausea and vomiting alluded to in sections 4 and 5, which symptoms are persistent, and occurred in my experiments always with an empty stomach, the experiments being made an hour or two before dinner. Mr. Carmichael, assistant to Dr. Simpson, has mentioned to me some facts which confirm the view I have taken. At one period, for more than a week, Dr. Simpson and Mr. Carmichael were kept in a state of continual anxiety by the occurrence, in all the puerperal cases in which chloroform was used, of very unpleasant symptoms, particularly of frequent pulse and other febrile symptoms, lasting for some days. At last, after much annoyance from this cause, it occurred to Dr. Simpson that he was using one particular specimen of chloroform, above the average in quality. As soon as this idea occurred, he threw away all that remained, and returned to that he had generally used. The unpleasant symptoms no longer appeared. [I regret much that I had not an opportunity of examining that specimen; but I may add, that the maker, not an Edinburgh one, now produces chloroform of much better quality, but not yet absolutely pure.] But the striking fact is this, that Dr. Simpson and Mr. Carmichael state, *that during the period above alluded to, when that one kind of chloroform alone was used by them, their handkerchiefs became quite offensive from the smell left on them, which even adhered to them after washing.* There can, I think, be no doubt, that here the oily impurities alluded to in sections 4 and 5 were present in notable quantity.

I may add, for the maker, that, after distilling the materials which yield chloroform, no distillation or rectification is needed. He has only to wash the heavy fluid with water till its volume no longer diminishes, and then to use the sulphuric acid as above, finishing with oxide of manganese. Distillation with the acid is of no use, because no proper contact can take place, the chloroform distilling from the surface as it would from mercury. In testing by sulphuric acid, it is best to use some ounces of chloroform, and to shake it in a phial, because in a test-tube, the color produced, if not strong, may be overlooked.

While I acquit the makers of chloroform who have sold an impure drug of all desire or intention to adulterate it, I feel it my duty to point out, that the system which permits *any one* to set up as a manufacturer of this or any other potent remedy, without let or hindrance, without any test of his qualifications, without, in short, enforcing a knowledge of chemistry and pharmacy as an essential condition, is a radically bad one; and that our law, in relation to druggists and apothecaries, requires reformation. In fact, the evils naturally resulting from it are only neutralised, and that but in part, by the good feeling and principle of the leading manufacturers.

To illustrate this, I may remark, that some of the makers of chloroform must have been very ignorant even of what was known and published concerning its properties; for among the specimens I examined are several of specific gravity below 1·480, which was long ago given as the standard, even so low as 1·347.

That this neglect proceeded more from ignorance than from intention, is, I think, plain from the fact, that a specimen labelled "Pure Chloroform," actually contained only a trace, about one-thirtieth, of that substance. I did not ascertain its specific gravity, which must have been far lower than 1·200 or 1·100, nay, possibly, under 1·000, because its impurity was so obvious in every other respect, and the quantity I had was too small; but on examining it further, I am convinced that its origin was this:—The maker, after distilling the materials, obtained of course two liquids, a lighter and a heavier. He evidently *did not know* that the latter was the chloroform, and therefore threw it away, and preserved *the lighter*—a mixture of pyroxylic spirit, of its natural impurities, of the deleterious chlorinated oils, and *a trace* of chloroform. At least, such are its characteristics; and it exactly resembles what would be obtained in the way supposed. But what a fearful degree of ignorance (without any evil intention) is here exhibited! And yet this maker was free to produce and sell *pure chloroform*, which was actually almost *pure from chloroform*, and loaded with deleterious agents.

ON THE BITTER PRINCIPLE (OR CATHARTIN) OF RIPE BUCKTHORN BERRIES.*

BY DR. F. L. WINCKLER.

THE following description of the bitter principle, *cathartin*, procured from the ripe berries of *Rhamnus catharticus*, is given by Dr. Winckler. It is a perfectly combustible powder of a pale gold color, soluble in any proportion in water and spirits of wine, moderately soluble in alcoholised ether, and but sparingly in pure ether. The aqueous solution is transparent and nearly colorless, with a very disagreeable permanent bitter taste, similar to a solution of the bitter matter of aloes. It affects neither litmus nor turmeric paper, but its reaction on a solution of chloride of iron and acetate of lead is so striking, that the peculiar character of this bitter matter is readily ascertained by means of these substances. The first immediately produces a dark brownish green color and no precipitate; acetate of lead, alkalies and ammonia, give it an intense brownish yellow color, like gold, which is destroyed by acids. This effect of acetate of lead satisfactorily proves the absence of tannin, which the reaction with chloride of iron might have led us to suspect: no other test could have discovered this. Cathartin melts into an oily liquid over the flame of a spirit lamp, at a slight heat, which becomes brown with a simultaneous development of a vapor with a peculiar odor, and igniting, leaves a very voluminous coal which is entirely combustible, although with difficulty. He obtained a compound, from a solution in spirit of wine of ninety-five per cent. of the still impure bitter which was insoluble in spirit of wine, and which was converted into pure grape sugar, of which aqueous solution (twenty grs. of sugar in two ounces of distilled water) on the addition of well-washed yeast at 88° to 95° F., rapidly passed through the process of fermentation.

The conclusion drawn from this by Dr. Winckler is, that the Rhamnin obtained by Fleury from the unripe berries (*Pharm. central Blatt.*, 1842, p. 220) becomes in the ripe fruit cathartin and grape sugar, and, consequently, can be obtained only from the pulp and juice of unripe berries.

* *Jahrbuch für Prakt. Pharm.*

ANALYSIS OF THE SEEDS OF THE WHITE POPPY.*

BY M. SACC.

THE seeds of the white poppy have been examined by M. Sacc. The plant was grown in the domain of Colombier, near Neufchatel, ninety metres above the level of the sea, in a brown chalky clay soil, and the fruit was gathered in 1838. After deducting 3·0292 per cent of hygrometric water, these seeds contained :—

Expressed oil	45·1166
Colored oil extracted by alcohol	9·4979
Volatile substances	3·5450
Pectine	23·2636
Protein matter	12·6448
Woody matter	5·9321
	100·0000

Drying the seeds in a current of carbonic acid, caused a loss of 6·8618 per cent. of water, after which the dried seeds yielded :—

	Mean of two experiments.
Carbon	61·2338
Hydrogen	9·2014
Nitrogen	3·5924

The roughly-expressed oil cake yielded :

Carbon	47·7468
Hydrogen	6·7582
Nitrogen	5·9723

When exhausted by ether it gave :—

Carbon	42·2728
Hydrogen	6·0418
Nitrogen	7·6441

The anhydrous oil contained :—

Carbon	76·6279
Hydrogen	11·6329
Oxygen	11·7392

The undried seed left 5·3897 per cent. of ashes; the dried seed, 7·0002 per cent; the moist rough oil-cake, 8·6599 per cent; the dried ditto, 10·58675 per cent; exhausted by ether, 13·2031 per cent. To analyse the ashes, the seeds were pressed, and the oil cake incinerated. The ashes contained, in 100 parts :—

Silica	4·84
Sulphuric acid	1·99
Phosphoric acid	37·81
Magnesia	4·33
Lime	28·08
Soda	4·47
Potassa	0·82
Carbonic acid	17·66
	100·00

* *Ann. de Chim. et de Phys.*, 3 sér., t. xxvii., pp. 470-490.

PRUSSIATE OF IRON IN CHOREA.

BY M. FAIVRE D' ESUANS.

THE author states that he has obtained the most beneficial results from the use of prussiate of iron in chorea and epilepsy, and he mentions several cases in which the cure was effected in from 4 to 8 days. He adopts the following formula :—

Prussiate of iron..... 15 grains
Extract of valerian.... 45 grains.

Make 24 pills. One pill to be taken three times a day, at six hours' interval, each pill to be followed by a wineglassful of infusion of valerian. He was led to try the prussiate of iron from having seen it used by M. Jourdes at the Military Hospital, Strasburg, in intermittent fever. As he considers that both diseases (chorea and ague) have their seat in the medulla spinalis, he thought that the same remedies would prove efficacious in both complaints, in which supposition, according to his statements, he was not deceived.

UNGUENTUM POTASSII IODIDI*

BY M. A. W. BRIEGER.

M. BRIEGER from a number of experiments concludes, 1.—That both carbonated and calcined magnesia, rather promote the decomposition of the iodide of potassium, than prevent this ointment from becoming yellow; 2.—That carbonate of potassa is somewhat better adapted for this purpose; 3.—That a solution of caustic potassa is far more effective; a few drops will suffice to preserve four to eight ounces of ointment for many months without changing the color, or will restore the white color to that which has already become yellow.

NEW MODE OF ARRESTING INFLAMMATION.

M. ROBERT LATOUR recently communicated to the Academy of Sciences of Paris, a paper wherein he endeavored to prove that any inflammation manifesting itself on the skin may be arrested by covering the inflamed integuments with an adhesive compound, capable of entirely preventing the access of atmospheric air. This idea was suggested to him by the experiments of Dr. Foucault, who produced great disturbances of internal organs in animals by painting them all over with a resinous, adhesive compound. M. Latour formerly used gum for covering the parts, but has now substituted collodium for it. Two cases of erysipelas were mentioned, which were thus cured in a few days.

* *Jahrbuch für Prakt. Pharm.*

ON THE ARISTOLOCHIA CLEMATITIS.*

BY DR. F. L. WINCKLER.

THE following account of the volatile oil and bitter principle of this plant is given by Dr. Winckler:—The distilled oil, after the subsidence of the mucus, is of a pale orange yellow color. Dry iodine slightly heats it. Exposure to the air for a short time causes it to assume a deep color, the odor is changed, it becomes soft like resin, and it then has the odor of balsam of copaiba: 120 grs. of clear oil were produced by distillation by steam from four pounds of the root.

The bitter matter was extracted from the residual root by liquor ammoniæ; the solution was mixed with dilute sulphuric acid, which precipitated almost all the bitter matter in flakes. This precipitate being dissolved in alcohol at 80 per cent., and the solution nearly deprived of color by animal charcoal, it was evaporated, and an amorphous light brown yellow residue was obtained. This was deprived of resin by frequent solution in cold water. This substance readily attracted water in this condition in consequence of the salts contained in it. Although insoluble in ether, it was soluble in water and alcohol. It had a powerful bitter flavor. Dr. Winckler thinks it precisely similar to the bitter matter of the *Rad. Serpentariæ* (*Aristolochia Serpentaria*. It is neutral, and precipitable by basic acetate of lead and nitrate of silver.

COD LIVER OIL.

IN our Nos. for October and December, 1849, we took occasion to notice the analysis of the cod liver oil, extracted by Messrs. Langton, Brothers, & Scott, from the *healthy* and *fresh* livers of the cod, at their recently established factory, at St. John's, Newfoundland, instead of, as in the old way, allowing them first to become putrid. by the plan they have adopted, the oil is procured of an agreeable odor and flavor, of a light straw color, and possessing, in the highest degree, the valuable medicinal properties for which the cod liver oil is now, as it was some centuries ago, very highly prized. The analysis was carefully made by Mr. Aikin and Dr. Alfred S. Taylor, and we made an examination of it ourselves. We are much pleased to hear that these gentlemen, who, seeing the necessity of procuring pure cod liver oil, opened their establishment at Newfoundland at considerable expence, are likely to reap the advantage of their spirited enterprise.

* *Pharm. Central-Blatt*,

OLEUM HYOSCYAMI INFUSUM.*

BY M. OVERBECK.

DRY the best fresh, green henbane, at the lowest temperature possible, then rub it into a coarse powder, mix it with sufficient spirit of wine to enable it to stick together. Leave the whole in a covered vessel for twenty-four hours, shaking it frequently. Now place it lightly on a funnel, the lower opening of which is closed with cotton or tow, and pour over it a sufficient quantity of warm olive-oil; this, in running through, becomes saturated with the active principles of the henbane which are extracted by the spirits of wine. Finally, press the powder, and heat the oil in the sand-bath to drive off the alcohol. Allow it to deposit; and afterwards decant it. An intensely dark-green oil is thus obtained, with a very powerful disagreeable narcotic odor of henbane, which sufficiently indicates its active qualities.

ON THE PURIFICATION OF HONEY.†

BY M. ANDRÉ HIRSCHBERG.

DILUTE 25 pounds of honey with half the quantity of water, and boil with a pulp formed by stirring, over a slow fire, sheets of white blotting paper in water, until the pulp becomes resolved into a fine fibre. When cold, place the whole in a previously moistened woollen filtering bag, through which the honey soon runs as clear as wine. Wash the remaining paper pulp and evaporate the dark yellow liquid in a steam bath. The honey thus obtained, according to M. Hirschberg's observations, answers all the purposes for which a faultless purified honey may be required.

THE CORRESPONDENCE BETWEEN MESSRS. HEATHFIELD AND BURGESS, AND MESSRS. J. AND J. WRIGHT.

To the Editors of The Chemist.

Princes Square, Finsbury,
May 16, 1850.

GENTLEMEN—We have not received any reply from Messrs. Wright on the subject of the morphia furnished by us, and stated by them to have been impure; we therefore desire to inform you that both the acetate and muriate of morphia were perfectly pure when they were delivered to Messrs. Wright, and we are bound to believe that they have not undergone any scientific examination at all.—We are, Gentlemen,

Your most obedient servants,
HEATHFIELD & BURGESS.

* *Pharm. Central Blatt.*, 1850, p. 112.
† *Archiv. der Pharm.*, xxix. p. 308

IV. REVIEWS, NOTICES OF BOOKS, &c.

PEAT CHARCOAL AND SANITARY REFORM. By JASPER W. ROGERS, Esq., C.E. London: Published at the Sanitary Engineering Offices, 88, St. James's Street. 1850, pp. 16.

THIS pamphlet has recently been issued to call attention to an establishment, which may almost be denominated the rival to Gwydir house. At the latter place sits a public Board with a staff of inspectors, medical reporters, clerks, &c. &c., acting under the authority of a certain "Public Health act;" the object of whose labors is to direct the sanitary improvements of all towns, except that in which they meet and from which they issue their orders; and the result of whose orders is, that every town is alarmed at the frightful expense enjoined upon it and from which it cannot escape when once "reported." At the former place is established a small band of engineers, acting on the principles of chemical and scientific knowledge, the object of whose labors is, to effect the sanitary improvement of all towns and country places, but more especially of that gigantic town from which their efforts are directed; and the result of whose advice and labor is, that every town may obtain a complete sanification, by a system which, instead of involving heavy burdens, will produce a considerable revenue. Such at least is the case as stated by the latter body. With respect to the former part of it, viz., that which relates to the Board of Public Health, it is undoubtedly true, as any one may judge for himself by reading carefully the published Reports of Inspectors on the different towns, and enquiring into the subsequent proceedings in each case. With respect to the latter part of the case, this pamphlet and two others issued by Mr. Rogers, viz, "An Appeal for the Irish Peasantry," and "Two Papers read at the London Botanical Society in 1849, by Jasper W. Rogers, Esq.," will enable us to form some opinion.

Referring to the treatment of Sewage, Mr. Rogers says—"Several chemical deodorisers have been produced, but, being liquids, the advantages proposed to be obtained, have been neutralised by the increased difficulty of reducing the matter to a sufficiently dry state for transport, and in drying by evaporation, under any circumstance, the main principles of its value, viz., the ammoniacal and other volatile gases, of necessity, pass away in the operation.

"It has, however, been my good fortune to discover that peat charcoal, specially prepared for the purpose, possesses the power of absorbing and retaining all those most valuable products. It is, perhaps, the greatest absorbent known. It will take up and retain above 80 per cent of water, and above 90 volumes of those gases. Hence its inestimable capability for effecting the deodorisation of excretiæ, and retaining all the virtues of the liquid matter, as well as its volatile products.

"Two-thirds or equal parts of prepared peat charcoal to the remaining proportions of excretiæ will totally absorb the whole matter, producing a manure of almost incalculable value."

Several public demonstrations have taken place, at which the instantaneous effects of the mixture of peat charcoal with night soil, were plainly exhibited. We have ourselves also seen most nauseous drains and cesspools made perfectly inodorous, by the application of a much less proportion of peat charcoal than is stated to be requisite in the above Extract. Not only is the *absorbent* quality of the charcoal immense, but it appears to have also a singularly powerful *attraction* for the gases given out from decaying animal and vegetable substances.

The method of applying the peat charcoal is as follows; viz., where the houses are provided with water-closets, the drains from several contiguous houses are brought to one point, and pour their contents into a tank, under the pavement, containing peat charcoal; the solid part of the drainage is retained, and the liquid passes off into the sewer, free from noxious matter whether volatile or fixed, and in fact almost pure. The contents of the tank would be removed once a quarter, the principle of intercepting from the main sewer, and at once killing those gases which kill us, being what I respectfully but strenuously urge."

When houses are provided only with cesspools, the latter are filled up, and a box or drawer placed under the privy, containing charcoal. A simple contrivance effects the mixture of the excretiæ with the charcoal; the whole contents are removed periodically, and fresh charcoal inserted in the box.

"During the whole period no odor will

arise. At the instant of emission, the aqueous and other matter will be absorbed, and the manure thus obtained will be of a much more valuable description than that from the water-closet tanks. In the latter the water carries away a certain portion of the nutritive value, but in this instance it will be all retained."

The estimated revenue, after deducting all charges, and including the cost of the charcoal, is very fairly shown to be at the rate of about £7 per ton of excretory matter; and that is supposing the market value of the combined manure to be only £5 per ton, whereas it contains much higher nutritive powers than guano, the price of which varies from £7 to £12 per ton.

Mr. Rogers proposes that, in London, about 300 public closets and urinals should be established in different parts. By the adoption of this proposal, not only would much that now offends both the public eye and the public nose be removed, but a remedy would be provided for even a far worse evil, and one of which the public generally has little idea, viz., the single privy common to all the inhabitants of each court and bye-lane of this city. Any amendment of the latter fearful evil, would tend largely to the moral benefit of the lower orders, and be an incalculable boon. A considerable revenue is estimated from this source also.

Having given this epitome of Mr. Rogers's plans we may add, that failing their adoption in such an immense place as London, a vast benefit would still be derived by interrupting the foul drainage before its discharge into the river. The sewage might be received into tanks at the mouth of each sewer,—the death-dealing matters be extracted and converted into the means of giving life and substance to millions,—and our noble river be permitted to flow and reflow in untainted glory, the source of pleasure and health to the millions who inhabit its shores, instead of as at present, the source whence rises during summer heats, a pall of disease and death which hovers like a destroying angel over the devoted, the foully abused city.

The value of the combined substances, peat charcoal and sewage as a manure, is undoubtedly so great, that it is difficult to estimate the amount of advantage that will ensue from its use, in increasing the productive power of the land.

"The farmer will observe the use of charcoal as a manure is not only profitable for its own sake, but for the avidity with which it absorbs and slowly emits, for the use of plants many of the various products of putrefaction."

"Professor Phillips's analysis of peat charcoal, prepared for the Irish Amelioration Society, for deodorising purposes, is as follows: 100 parts—

Carbon	79·24	88·42 Combustible matter.
Hydrogen	2·20	
Nitrogen	0·54	
Oxygen	6·44	
Sand and Clay	2·48	11·58 Incombustible matter.
Oxide of Iron	1·66	
Phosphoric Acid	0·34	
Silicate of Potash	0·98	
Chloride of Sodium	2·53	
Carbonate of Lime	1·85	
Sulphate of Lime	1·44	
Loss	0·30	
	100·00	

"Add to this ammonia, gluten, phosphates, urea, &c, contained in human excreta, and it will be obvious that it is perhaps impossible to produce a combination more perfectly adapted for the food of plants. All the elements for their nurture are interwoven, it may be said, into every grain of charcoal; carbon, the staff of vegetation, is the base, and the whole are yielded to the plant together. It is well known that the strongest affinity exists between the ammoniacal and other atmospheric gases, and carbon; and here again a singular advantage arises. Every shower of rain that falls, gives a greater supply of the ammonia, salt, &c., contained in that rain, to the charcoal. Hence it is not only the means itself of giving health and strength to the plant, but every little grain becomes a reservoir, not alone of manure, but moisture, both of which never cease to act upon, and invigorate the vegetable."

It is well known that liquid sewage manure has produced astonishing results upon land, and that several crops have been obtained in one season from previously poor land. But in this there is but 5 per cent. of the whole weight which affords nutriment, and of the substance conveyed, nearly all the volatile portion escapes; so that independently of the cost of transport, the farmer is cumbered with an article (water) in much greater profusion than is useful. In the English guano manure (so to call it) every volatile as well as fixed matter is preserved, and there is not an ounce of waste in the whole substance.

Many experiments are detailed by Mr. Rogers, in his various pamphlets, of the results obtained from the use of charcoal manure in multiplying the productive powers of land. Some extensive experi-

ments are in progress at the present time by English agriculturists; and we shall endeavor to obtain an early knowledge of the results.

There remains one more value in peat charcoal to be related in connection with sanitary reform, viz., as a filterer of water. It possesses the peculiar property of retaining both the mechanical and chemical impurities of water passing through it. In this respect it may be of value in solving several difficult problems connected with the filtration of the ordinary "water supply."

In conclusion, we heartily wish success to Mr. Rogers in his scientific and most philanthrophic labors.

OUTLINES OF EXPERIMENTAL CHEMISTRY; *Being a Familiar Introduction to the Science of Agriculture.* Designed for the Use of Schools and Schoolmasters. By THOMAS TATE, late Mathematical Professor and Lecturer on Chemistry in the Battersea Training College, &c., &c. London: Longmans. 1850. pp. 92.

THIS is a very useful little manual, and an acquisition of the amount of knowledge it conveys may lead a thinking person to seek further. It will serve this object well. It is impossible for any one to practice chemistry with advantage, unless he will take the pains to acquire a knowledge of it by long and careful study. Fools may imagine that when they know a little, they know all. Such will derive no advantage from *any* book. The application of chemistry to agriculture, to be successful, must be based on accurate knowledge.

The author's object is to make chemistry a branch of elementary instruction We recommend his work to schoolmasters and parents, as one from which boys will derive real advantage.

THE GENERAL MALARIA OF LONDON AND THE PECULIAR MALARIA OF PIMLICO INVESTIGATED, AND THE MEANS OF THEIR ECONOMICAL REMOVAL ASCERTAINED. By ANDREW URE, M.D., F.R.S., &c. London: Wm. S. Orr & Co. pp. 39.

IF we had ever felt the slightest disposition to doubt the Dr.'s right and title to a full share of his country's motto, the present brochure would have settled the matter in a moment. The "nemo me impunè lacessit" is stamped upon every page, and a sorry figure truly do his antagonists cut. Our readers will no doubt remember the fatal catastrophe which occurred in Kenilworth Street some months ago, when five individuals lost their lives in a sewer. At the inquest held on the bodies, it was attempted to be proved by Drs. Lyon Playfair, Miller, and others, that nothing peculiar existed in the contents of this sewer, but that the accident which had resulted in such a wholesale destruction of life was owing to the operation of ordinary causes acting within every sewer and merely rendered more noxious in this instance by the fact that one end of the Kenilworth-Street sewer was blocked up with brickwork. In vain did the inspectors of sewers declare that there were hundreds of other sewers blocked up in the same way, and which were nevertheless harmless—in vain did they protest that a something unusual and unprecedented was present in the atmosphere of this identical sewer—and in vain did Dr. Ure exhibit samples of Prussian blue obtained from the water of the sewer to the vacant gaze of the coroner's jury, and explain to them the connection between this blue and the cause of the accident. They would not or could not understand the argument, and therefore turned with ready credulity to an erroneous and irrelevant piece of geological sophistry mouthed out for the occasion by the scientifically non-existent chemist to the notorious Woods and Forests. The coroner's jury wished for humbug, and they had it. "Populus vult decepi, et decipiatur." So they came to a conclusion that several tons of gas lime refuse laying upon the arch of the sewer had nothing to do with the death of the men, and that percolation from above through the roof and sides of the sewer was impossible. The doctor's pamphlet will go far to set them right on this head, for a more candid, lucid and satisfactory narrative we have seldom seen. The most remarkable part, however, of this matter is, that neither Dr. Lyon Playfair, nor Dr. Miller, nor, in fact, any of the other chemists employed, could detect prussic acid or any cyanogen compound in the contents of this sewer, although an enormous quantity was present, ac we ourselves ascertained at that time from two or three different samples taken at separate times and places from the sewer. Now one of two things must be correct in reference to this analytical question: Dr. Lyon Playfair & Co. either detected prussic acid, or they did not. If they did detect it, what shall we say to the value of their oaths?—if they did not, what estimate are we to form of the worth of their scientific attainments? These are serious subjects to men calling themselves chemists and pretending to instruct others, for we repeat

that the quantity of cyanogen compounds existing in this sewer was absolutely enormous, and, if properly extracted, would have poisoned many thousands of persons. Amongst the worthies whom the doctor has impaled upon this occasion, we notice one extremely like our old friend Jacob, and who is described as "the editor of a monthly journal who had mystified himself, and discovered either an amazing ignorance or a total want of the organ of logic." (p. 18.) Now if this does not mean Jacob, who can it possibly mean? In conclusion, we recommend the pamphlet to our readers as an interesting specimen of vindicatory research.

METROPOLITAN WATER SUPPLY, PRESENT AND FUTURE. In four Letters to the "Daily News" Newspaper. By JOHN LOUDR TABBERNER. London: Renshaw. 1850. Pp. 58.

MR. TABBERNER has for some time been prominently before the public as a denouncer of the monopoly which has been enjoyed for so many years by the existing Water Companies, and his opinions are so well known, that there is no occasion for us to recapitulate them here. We therefore recommend the pamphlet to the perusal of all who are interested (and who is not)? in the subject. Something really must be done at once, or we shall run considerable risk during the ensuing summer.

OUTLINES OF QUALITATIVE ANALYSIS FOR LABORATORY PRACTICE. By SHERIDAN MUSPRATT, Ph. D., F.R.S.E. London: Taylor, Walton and Maberley, 1850.

THIS work will be found useful in the laboratory. Dr. Muspratt, in the preface, states that he has "tested its usefulness" in watching the labors of his own pupils.

TO CORRESPONDENTS.

"Mr. BETA."—We are well aware of the great difficulty of obtaining the article, "pure potassa," absolutely pure, or even in a state approaching to purity, and that nearly all that is sold by those who profess to sell pure chemicals, is contaminated with impurities—chiefly chloride of potassium. We have examined some prepared by several manufacturers, and especially by one who is ever on the alert to expose adulteration and carelessness of preparation when others are even only supposed to be in fault, and who has occasionally of late cut rather a sorry figure, owing to the inaccuracy of his statements, and we have found a very considerable quantity of chloride. We must impress it on our Correspondent, and our Readers generally, that color is no criterion of purity; for it is well known that it is much more easily prepared white when impure, than when pure. The article prepared by means of alcohol can boast of very little superiority over the other. The price charged by these people is such as to enable them to endeavor to obtain it far more pure than they do, if only for honesty's sake. We are fully acquainted with the extreme difficulty of removing all traces of chloride of potassium; but if well prepared, when dissolved in water, and saturated with nitric acid, nitrate of silver produces only a very slight turbidness, whereas the well known curdy precipitate of chloride of silver is very abundant in all that we have procured from the makers above alluded to.

"R. M. H. (Coventry)."—The only mode of acquiring the information is to write to the author.

"STUDENT."—You have proceeded correctly.

"A CHEMIST" is informed that we have our eye on the parties alluded to. We recommend him to have nothing to do with them.

"T. T."—Nitric acid diluted with 4 times its bulk of water.

"M. D."—Benzoate of ammonia.

"A RUTLANDSHIRE FARMER."—It depends on the nature of your soil; write to us on this point.

"MEDICULUS."—Scammony.

Communications have been received from "D. D.;" "Mr. H., a Member of the Pharm. Soc.;" "MEDICO BOTANIST;" "Mr. DAVIS;" "Mr. H. F. HENDERSON;" "G. T.;" and "Mr. BOTTERILL," and will be attended to.

The Liverpool Journal of May 4th has reached us.

"CHEMICUS (Edinburgh)" "W. W.," "A SUBSCRIBER (Liverpool)," "A DRUGGIST," "SPECTATOR," and "A HATER OF HUMBUG," who wrote on the subject of the Pharmaceutical Society, are recommended to act, and we have no doubt they will find that some good will be done. Some one must commence.

NOTICE.—*All Communications, Books for Review and Substances for Notice must be addressed* "To the Editors of THE CHEMIST, care of Messrs. W. & T. Piper, Paternoster Row, London." *Communications for insertion must be prepaid, and sent before the 15th of each month. Letters requiring a reply in the following No. will in future be received as late as the 24th.*

THE CHEMIST.

[NEW SERIES.]

I. CHEMISTRY.

ON SOME OF THE SALTS OF CHROMIC ACID.*

BY MR. JOSEPH DANSON,
STUDENT IN THE LIVERPOOL COLLEGE OF CHEMISTRY.

No analysis existing of several of the chromates, and the meagre amount of information we possess with regard to others, induced me at the suggestion of Dr. Muspratt, to undertake this subject. I have prepared and analysed a series of salts particularly with the view of ascertaining whether they correspond with the sulphates. Composition of the two acids:—

Sulphuric acid..... SO^3
Chromic acid..... CrO^3.

I. THE CHROMATES OF ZINC AND COBALT have a great tendency to carry down with them portions of the precipitant, which alone would prevent their composition being analogous to that of the sulphates. To obtain several of the chromates in a state fit for analysis, is perplexing to a degree which can be known only to the operator. In one instance, I had to wash for upwards of a fortnight, and in few cases did I wash the precipitate for less than a week: this alone is sufficient to deter many from thoroughly investigating the salts of this acid.

II. CHROMATE OF MAGNESIA.

This salt was formed by dissolving magnesia in an aqueous solution of chromic acid; the solution was concentrated on the water-bath, and then allowed to cool, when a quantity of red crystals were deposited, which, when collected on a filter and dried in vacuo over sulphuric acid, became of a yellow color. I only determined the water in this salt, because I found that it corresponded with one analysed by Professor Graham, and not with that described by Dr. Thomson, who found only 2 equivalents of water.*

Analysis of the Salt.

·4295 grms. of salt lost ·1660 grms of water=38·65 per cent.

		Centesimally represented. Theory.	Found.
1 eq. magnesia.....	21	17·796	
1 ,, chromic acid..	52	44·068	
5 ,, water.....	45	38·136	38·65
	118	100·000	

Formula, $MgO\ CrO^3+5aq.$

When alcohol is added to the supernatant liquid of the above salt, a bulky, feathery, crystalline precipitate of a yellow color subsides; this was collected on a filter and dried between folds of bibulous paper and analysed, but, owing to the small quantity, I was only able to determine the amount of chromic acid.

Analysis of the Salt.

·2698 grms. of salt gave ·074 grms. of sesquioxide of chromium=·0962 chromic acid=35·65 per cent.

		Theory.	Found.
1 eq. magnesia.....	21	14·48	
1 ,, chromic acid..	52	35·86	35.65
8 ,, water.....	72	49·66	
	145	100·00	

Formula, $MgO\ CrO^3+8aq.$

III. CHROMATE OF BISMUTH.

When a solution of chromate of potassa is added to finely pulverised nitrate of bismuth, a lemon-colored powder is formed.

* Communicated by the Author.

* Brande's *Manual of Chemistry*, 6th edit., p. 949.

The precipitate was collected on a filter and washed until the liquid percolating appeared colorless, but when a large body of the filtrate was present, it had a slight yellow tinge. When potassa is added to the precipitate and heated for a short time, the color is changed to an orange, owing to the formation of the subchromate of bismuth.

$$2\,(BiO^3CrO^3)+KO=2\,BiO^3,\,CrO^3+KO\,CrO^3.$$

The salt was dried in the water bath. When a portion was heated in dry test, no moisture was given off.

Analysis of the Salt.

Dissolved in weak hydrochloric acid, and passed sulphide of hydrogen gas through the solution until it had acquired a very strong odor of the gas; the precipitate was filtered off and well washed, the filtrate was boiled until the excess of gas was driven off, when ammonia was added; and the whole was again boiled; the menstruum was allowed to cool before filtering; from the quantity of sesquioxide of chromium obtained, the amount of chromic acid was calculated.

Analysis of the Salt.

I. ·3193 grms. gave ·0434 grms. sesquioxide of chromium=·0564 chromic acid=17·66 per cent.

II. ·3210 grms. gave ·0457 grms. sesquioxide of chromium=·0594 chromic acid=18·50 per cent.

	Theory.	Found.		Mean.
		I.	II.	
1 eq. oxide of bismuth....	237	82·007		
1 ,, chromic acid.....	52	17·993	17·66	18·50	18·58
	289	100·000		

Formula, BiO^3CrO^3, or $BiO^3CrO^3+2\,BiO^3$.

IV. CHROMATE OF TIN.

Chromate of potassa converts the protochloride of tin into the bichloride of tin with the formation of sesquioxide of chromium and chloride of potassium. The following equation represents the conversion:—

$$6\,(SnCl)+4\,(KO\,CrO^3)=2\,(Cr^2O^3)+5\,SnO^2+SnCl^2+4\,(KCl).$$

Bichromate of tin.—When chromate of potassa is added to the bichloride of tin, a yellow precipitate falls down which, when well washed and dried in the water bath, becomes of a yellowish-brown color. I have not arrived at any definite results as yet, but in all probability the composition is:—

$$SnO^2\,2\,CrO^3+5\,aq\ ?$$

V. CHROMATE OF COBALT.

When a solution of chromate of potassa is added to one of nitrate of cobalt, no precipitate at first appears, but a brown powder gradually falls, leaving the supernatant liquid of a yellow color. The precipitate was collected on a filter and washed with water for 12 or 14 days, when a portion of the washings, on being boiled for a short time, deposited a brown powder which was found to contain cobalt. The salt, after being dried in the water bath, lost on heating 15·84 per cent.

Analysis of the Salt.

It was heated to redness, and then digested with water which dissolved out the chromate of potassa; the residue was separated by filtration, and the filtrate evaporated to dryness, and weighed.

·1515 grms. of salt gave ·016 grms. of chromate of potassa=10·561 per cent.

	Centesimally represented. Theory.	Found.
9 eq. chromate of cobalt	810	89·109
1 ,, chromate of potassa	99	10·891	10·561
	909	100·000

Formula, $9\,(CoO\,CrO^3)+KO\,CrO^3$.

VI. AMMONIA-CHROMATE OF SILVER.

This salt was obtained by dissolving the red chromate of silver in ammonia. The solution, which was of a pale yellow color, was boiled, and then allowed to crystallise by spontaneous evaporation, when a quantity of yellow prismatic crystals was deposited, which were collected on a filter, and dried.

Analysis of the Salt.

·1965 grms. of salt gave ·1286 chloride of silver=·1039 oxide of silver=52·87 per cent., also ·035 grms. of sesquioxide of chromium=·0455 chromic acid=23·15 per cent.

	Centesimally represented. Theory.	Found.
1 eq. oxide of silver.	116	52·72	52·87
1 ,, chromic acid..	52	23·64	23·15
2 ,, ammonia.....	52	23·64	
	220	100·00	

Formula, $AgO\,CrO^3+2NH^4O$.

I have prepared several of the chromates analysed by Mr. Darby,* which I will describe.

VII. DOUBLE SALT OF BICHROMATE OF POTASSA AND CHLORIDE OF MERCURY.

When a solution of bichromate of potassa

* *Quarterly Journal of the Chemical Society*, vol. i., p. 22.

is added to one of the chloride of mercury, no precipitate is formed; but when the solution was concentrated on the water bath, and then allowed to cool, a quantity of beautiful red crystals was deposited.

Analysis of these Crystals.

·2530 grms. of salt, dried at 212° F., gave ·1180 grms. of chloride of mercury=46·64 per cent.

		Theory.	Darby.	Danson.
1 eq. bichromate of potassa.....	151	52.8	48·6	
1 eq. chloride of mercury.....	135	47·2	51·4	46·64
	286	100·0	100·0	

Formula, $KO\,2CrO^3+HgCl$.

VIII. CHROMATE OF MERCURY.

A solution of chromate of potassa produces, when added to chloride of mercury, a yellow precipitate which gradually passes to a brick-red color. It is soluble in an excess of corrosive sublimate; potassa and ammonia both change it into a yellow precipitate; that produced by the latter subsides quicker.

Analysis of the Salt.

I. ·1578 grms. dried at 100° C. (212° F.), gave ·0175 grms. of sesquioxide of chromium=·0227 chromic acid=14·37 per cent.

		Theory.	Found.
3 eq. oxide of mercury	324	86·18	
1 ,, chromic acid.....	52	13·82	14·37
	376	100·00	

Formula, $3\,HgO+CrO^3$.

When the solution filtered from the above precipitate was evaporated to a small bulk, the deposit filtered off, and the filtrate allowed to cool; a quantity of red crystals was deposited, which were soluble in dilute hydrochloric and nitric acids, and water, yielding a yellow solution.

Analysis of the Salt.

·3900 grms. dried at 100° C. (212° F.), gave ·2865 grms. chloride of mercury= 73 46 per cent.

		Theory.	Darby.	Danson.
1 eq. chromate of potassa.....	99	26·83		
2 eq. chloride of mercury.....	270	73·17	72 30	73·46
	369	100·00		

Formula, $KO\,CrO^3+2HgCl$.

IX. SUBCHROMATE OF MERCURY.

When solutions of chromate of potassa and subnitrate of mercury are mixed together, a red precipitate falls down. It is slightly soluble in cold, and more so in hot water. When heated, it gives off oxygen and mercurial vapors, sesquioxide of chromium remaining. It is blackened by ammonia and potassa; hydrochloric acid converts it into calomel, liberating chromic acid.

$$4\,Hg^2O,\ 3\,CrO^3+4\,HCl=4\,(Hg^2Cl)+3CrO^3+4\,HO.$$

This salt has been described by L. Gmelin,* whose formula corresponds with the one I obtained.

Analysis of the Salt.

·2780 grms. of substance, dried at 212° F., gave ·0325 grms. of sesquioxide of chromium=·0422 chromic acid=15·18 p.c.

		Theory.	Found.
4 eq. suboxide of mercury	832	84·21	
3 ,, chromic acid.....	156	15·79	15·18
	988	100·00	

Formula, $4\,Hg^2O,\ 3\,CrO^3$.

X. DOUBLE SALT OF CHROMATE OF ZINC AND CHROMATE OF POTASSA.

When solutions of chromate of potassa and sulphate of zinc are mixed together, a yellow flocculent precipitate subsides. This was collected on a filter and washed, until the liquid percolating appeared colorless, but a large body of the fluid had a slight yellow color. The precipitate, after being dried in the water bath, lost 15 per cent. by heating to redness, leaving a powder which was green when hot, and dark brown when cold, from which water extracted 13½ per cent., the residue, dissolved in strong sulphuric acid, imparting to the menstruum a green color. It is slightly soluble in cold water: when the salt is boiled in water, it imparts to it a yellow color, leaving a bright yellow powder behind, which is most likely a basic salt.

Analysis of salt.

·6642 grms. of substance dried at 100° C. (212° F.) gave ·2505 grms. of sesquioxide of chromium=3256 chromic acid=49·02 per cent. also .0900 grms. of chromate of potassa=13·55 per cent.

		Theory.	Found.	
7 eq.	oxide of zinc	280	37·68	
7 ,,	chromic acid	364	48·99	49·02
1 ,,	chromate of potassa ...	99	13·33	13·55
		743	100·00	

Formula $7\,(ZnOCrO^3)+KOCrO^3$.

XI. CHROMATE OF NICKEL.

This salt is formed by dissolving the oxide in an aqueous solution of chromic acid; the solution, which is of a brown color, when concentrated on the water-bath, deposits, on cooling, a quantity of red crystals; these were collected on a filter and dried. Potassa gives with this salt a yellow subchromate.

* *Handbuch der Chemie*, vol. iii., p. 573.

Analysis of these crystals.

I. ·3560 grms of substance gave ·1159 grms. of oxide of nickel=32·55 per cent.
II. ·3625 „ „ „ ·1179 „ „ „ =32·52 per cent.

			Found.		Mean.
			I.	II.	
1 eq. oxide of nickel.....	38	32·48	32·55	32·52	32·53
1 „ chromic acid.....	52	44.44			
3 „ water.....	27	23·08			
	117	100·00			

Formula, $NiO\,CrO^3+3aq.$

XII. CHROMATE OF SESQUIOXIDE OF MANGANESE.

When strong solutions of chromate of potassa and chloride of manganese are mixed together, a chocolate-colored precipitate is produced, having a crystalline appearance when examined through a powerful lens. This was collected on a filter and washed with distilled water until bichloride of platinum gave no indications of potassa. It is slightly soluble in water, dissolves in dilute nitric and hydrochloric acids. The red oxide of manganese, obtained by dissolving the salt in dilute nitric acid and precipitating by potassa, was found on examination to contain quantities of sesquioxide of chromium, proving the whole of the chromium in the salt not to be in the state of chromic acid, but part as sesquioxide of chromium. Another portion was fused with nitrate of potassa and carbonate of potassa; the fused mass was boiled with dilute alcohol to decompose the permanganate; the red oxide of manganese obtained by precipitation did not contain a trace of sesquioxide of chromium, nor the filtrate any manganese. This salt is, no doubt, a chromate of the sesquioxide of manganese, with a definite amount of sesquioxide of chromium in mechanical mixture. When chromate of potassa is added to a salt of the oxide of manganese, a portion of the chromic acid is reduced to sesquioxide of chromium, which is precipitated in conjunction with the chromate of the sesquioxide of manganese; consequently the admixture must always be definite. I am at present engaged upon this salt, and hope soon to furnish its complete analysis and formula. The one given by Warington and Reinsch cannot be correct, or else the salt, when dissolved, if it contained oxide of manganese would give a *white* precipitate with potassa, which is not the case. Others have also lately examined this salt, and I am happy to say their views coincide with mine in regard to its composition.

ON THE COMPOSITION OF CORN.*

BY M. PELIGOT.

THE researches which I have the honor of submitting to the judgment of the Academy form part of a work which I have undertaken, with the view of determining the composition of the principal kinds of grain employed as food. The origin of this work was this: in consequence of the deficiency in the crops of cereals and potatoes during the years 1846 and 1847, which pressed so heavily on all the populations of Europe, the Minister of Agriculture and Commerce confided to the *Conseil de Perfectionnement* of the *Conservatoire des Arts et Métiers* the task of studying experimentally various agricultural and economical questions connected, either with the potatoe disease, which raged then in all its intensity, or with the cultivation and employment of various vegetable products required for public consumption. As a member of the official commission charged with the pursuing of the experiments, I was requested by my colleagues, MM. Boussingault, Payen, Morin, and Moll, to study the questions relative to the preparation of bread, and especially to make experiments with the view of obtaining with oat flour a finer and better bread, in all respects, than that which is made in some countries with that cereal. The interest which the solution of this question presents is so much the greater, as it remarked that oats are often abundant and at low price in years in which wheat is scarce and dear.

The endeavors which I made to make bread of oats not having succeeded, and circumstances not rendering it necessary to hurry my work—for, in 1846 and 1847, all sources of food having failed at once, the price of oats was maintained relatively higher than that of wheat—I was led to investigate, in the comparative examination

Annales de Chimie et de Physique, May 1850.

of wheat and oats, the cause of the differences observed in endeavoring to convert the flower of either of these cereals into bread: these differences are not explained by their composition; since, according to known analyses, wheat and oats contain the same substances combined in nearly the same proportions. This study has led me much further than I expected; for, in order to determine with some accuracy the composition of oats, I devoted much time in the first instance to determining that of wheat.

Wheat, in its natural state, has not been analysed in a complete manner by any chemist. Several works have been undertaken for determining the composition of farina, and many others have had the object of detecting the adulterations too often practised with regard to this alimentary substance: some researches have been made with the view of determining separately some of the principles of corn, such as water, fatty matter, nitrogenous matter, starch, &c.; but in trying to reduce these various results to order, we very soon find that it is impossible to deduce from them the normal composition of a single variety of wheat: this composition, moreover, varies considerably, sometimes in one and sometimes in another of its elements, according to the kind of corn, and especially according to the nature of the climate, soil, &c.

This gap I have, in some measure, endeavored to fill up: I have analysed, as completely as it was possible for me to do, a certain number of samples of wheat, of authenticated origin, representing almost all the principal sorts of commerce. I applied myself to determining the proportion of each of their elements. To attain this end, I employed, sometimes known methods, of whose correctness I satisfied myself, and sometimes new processes. The accurate analysis of alimentary substances so complex as corn, from the number and nature of their constituent principles, presents, in its execution, too many difficulties for me to flatter myself that it is unnecessary to recur to the results at which I have arrived. These difficulties, which are owing essentially to the insufficiency of the analytical processes, which we at present employ for separating from each other the substances called in organic chemistry neutral substances, are certainly of a nature to discourage many observers, especially as an accurate analysis of cereals does not promise to him who performs it any very new or unexpected result. Nevertheless, when we see the profits which commerce and manufactures can always derive from the knowledge of new chemical means which tend to establish, in a more accurate manner, the nature of products of general consumption; when it is considered that, in order to arrive at this important question—*to establish the real price of an alimentary substance*—it is necessary, above all things, to determine with accuracy the nature and proportion of the different substances of which it is composed, the utility of the result gives hope and patience to surmount the difficulties which must be encountered in order to attain it.

In wheat, and other cereals, these substances are numerous. It is known that the principal are: 1, water; 2, starch; 3, nitrogenous matters insoluble in water; 4, nitrogenous matter soluble in water; 5, non-nitrogenous matters soluble in water; 6, fatty substances; 7, cellulose; 8, mineral salts.

The insoluble nitrogenous matters are found in gluten, which contains, besides, several fatty matters. The nature of this product is therefore complex, like that of the matters which compose each of the groups which I have just established: thus, the soluble non-nitrogenous matters consist of dextrine, and, according to many chemists, of gum and glucose; so that the analysis of a cereal is still much more complex than it appears to be according to this enumeration. But, before determining separately each of the constituent elements of corn, it is necessary to know how to separate those which present the most decided characters, as the presence or absence of nitrogen, the solubility or insolubility in water, ether, &c.

This is the problem, laid down in these general terms, which I have endeavored to solve.

The only chemist who, to my knowledge, has tried to determine the composition of corn, taken altogether, is M. Rossignon. The results of his work are published in the third volume of M. de Gasparin's *Cours d' Agriculture*. These results, which proceed from the analysis of twenty-five kinds of corn, differ much, in several important points, from those I have arrived at. The differences are explained in part, by the same differences which the numerous varieties of wheat present in their composition: but they evidently especially result from the methods of analysis which we employed. I shall revert to this point in the course of this memoir.

The most complete work which has been published on the composition of wheat farina, is still, even now, that published by Vanquelin in 1822.* Although the compo-

* *Journal de Pharmacie*, t. viii. p. 353.

sition of corn cannot be deduced from that of the farina resulting from it, it is impossible not to take account of this work, when engaged in the analysis of cereals. It bears the impress of that spirit of patient and conscientious investigation which distinguishes all the works of that celebrated chemist; but, as is the case with most analytical works, these investigations have grown old, and the results which they represent can now be regarded as only approximative. Thus, the quantity of water, which Vanquelin estimated at from 10 to 12 per cent. in the farinas, is too low, owing to a dessication which, certainly, as M. Boussingault has already observed, must have been imperfect. The determination of gluten, which he executed by malaxating the farina under a stream of water, is far from accurate. It is now known that, with whatever care this operation may be performed, a certain quantity of gluten is lost, which flows out with the starch, whilst some of this latter substance remains with the gluten collected. Moreover, the desiccation of gluten is long and difficult; and it is certain that, as with the farinas, it was incomplete. Vanquelin did not determine the fatty matter, nor the nitrogenous matter soluble in water, &c.

M. Boussingault published, in his *Economie Rurale*, the analysis of twenty-four sorts of wheat farina as concerns the most essential point of this kind of analysis,—the proportion of nitrogenous matters. These wheats were gathered in the same year at the *Jardin des Plantes*, and cultivated, consequently, in very favorable and perfectly identical conditions. The nitrogenous matters were estimated by the process regarded as most accurate, the estimation of the nitrogen.

Several other chemists have determined some of the elements of corn. To MM. Dumas, Boussingault, and Payen, we owe the determination of the fatty matter contained in several samples of corn, farina, and bran;* Mr. Krocker has ascertained the proportion of starch contained in the cereals;† Mr. Horsford has determined the quantity of nitrogen in some samples of corn. These analyses form part of a considerable work which this chemist has published on the quantity of nitrogen contained in a great number of vegetable substances. M. Millon presented, in 1848, to the Academy of Sciences, a work on the proportion of water and ligneous matter contained in corn and in its principal products. Finally, the examination of the ashes of corn has been the subject of several researches.

The analyses which I am about to detail were made with samples very closely representing the principal varieties which, either from their composition or from their commercial importance, may be regarded as types. Most of them were furnished by M. Vilmorin, who placed at my disposal, with a readiness for which I am very much obliged to him, authentic samples, grown by himself and his foreign connections; others were derived from the interesting collection which my lamented colleague, M. O. Leclerc Thonin, formed for the course of agriculture which he professed at the *Conservatoire des Arts et Métiers*. Finally, M. Darblay sent me some samples which he regarded as most common in the Paris market.

To analyse each of these corns, obtained, as I have shown, from respectable sources, I commenced by grinding 50 or 100 grammes (1 gramme=15·434 grs. English) sometimes in a small coffee-mill, and sometimes in a portable mill which is said to have been in the Russian campaign, and which was found among the models of the *Conservatoire des Arts et Métiers*; this mill is formed, in its principal parts, of two channelled discs of cast iron, one of which receives a rotary motion by means of a handle, and rubs against the other, which is fixed: with this mill we can grind either coarse or fine, according as the grinding surfaces are nearer or further apart.

The corn thus ground was subjected to analysis without separating the farina from the bran. I preferred operating in this manner to attempting a separation, which always entails a certain loss, as M. Boussingault has observed. It must be admitted, moreover, that there does not exist any relation between the nature and the quantity of the products which sifting furnishes in operating on a small scale, and those given by bolting in the large way, which, itself, presents very considerable variations, arising much less from the nature of the grains than from the processes employed for grinding them. I have, nevertheless, examined, comparatively, farina and bran arising from the same varieties of corn, but with the conviction that the results which I have obtained represent only the sense of the results which will be obtained when we examine, by analogous means, farina and bran of the same varieties of corn obtained industrially.

From the results of my analyses, which will be found in the table which will con-

* Recherches sur l'Engraissment des bestiaux et la formation du lait: Annales de Chimie et de Physique, 3e Séne, tome viii., page 89.

† Berzelius' Jahrbuch, 8th year, p. 231.

clude this memoir, the following numbers express the average composition of corn.

Water	14·0
Fatty matters	1·2
Insoluble nitrogenous matters (gluten)	12·8
Soluble nitrogenous matters (albumen)	1·8
Dextrine	7·2
Starch	59·7
Cellulose	1·7
Mineral salts	1·6
	100·0

As the value of these numbers is entirely dependent on that of the methods of analysis which I employed, it is important to discuss these methods.

DETERMINATION OF THE WATER CONTAINED IN WHEAT.

This determination was made by drying in a Gay-Lussac's oil stove from 5 to 10 grammes of corn immediately after grinding. The matter, heated to from 230° to 248° F., was weighed several times until its weight underwent no further diminution.

An examination of the table, in which are given the results of the analyses of fourteen sorts of corn, shows that the water which they lost varies only between 13·2 and 15·2 per cent. of water. Our newly-reaped corn contains 17, 18 and even 20 per cent. of water. Contrary to the generally received opinion, I have not found more water in soft than in hard grains. This result does not imply, as a consequence, that the farinas of these corns should likewise contain the same quantity of water. It is proved that the farinas arising from soft grains contain more water and are more rapidly altered than those of hard corn; for this water, which, in healthy farinas, is found in the proportion of 16 to 20 per cent., and in a much larger proportion in damaged farinas, is derived partly from the atmosphere, during and after the operation of grinding; this derivation must be, consequently, proportional to the state of division of the farinaceous substance, which is commonly purer for soft than for hard grains. As to the spontaneous alteration which grains undergo in our climates, even when kept in hermetically-sealed vessels—which alteration is more speedy in soft than in hard or horny grains—I think that it must be attributed less to the quantity of water which these corns contain than to the less homogeneous nature of the grain of soft corn compared with that of hard corn.

FATTY MATTERS.

I devoted great care to the estimation of the fatty matters contained in corn. I treated the corn with ether, sometimes in the excellent continuous distilling apparatus invented by M. Payen, sometimes in tubes sealed at one end in an enameller's lamp, and at the other closed with a ground glass stopper; I have often employed both methods with the same corn. The latter requires more time, and involves a greater loss of ether; but it allows, in operating by decantation, of drying in vacuo, at an uniform temperature, the matter exhausted by ether, without its being necessary to remove it from the tube; the loss which it undergoes serves as a check to the weight of the fatty matters collected.

The ether which is employed in the determination of the fatty matter contained in products of the nature of corn should be rectified, and especially free from water; the corn should likewise be very dry. This double precaution is of the utmost importance; by neglecting it, we are in danger of committing in this operation, which is apparently so simple, considerable errors. Indeed, when we treat undried corn with ordinary ether, not only is the fatty matter dissolved, but at the same time a certain quantity of matters soluble in the water supplied by the corn and the ether itself. It is known that the *tanin* of M. Pelouze is prepared precisely in these conditions, which must be carefully avoided in analyses of this kind. Besides, corn, after having been treated by ether, should be divided, again dried, and subjected to further treatment with ether, until the residue furnishes absolutely no more fatty matter.

The proportion of fatty matter contained in different species of corn varies very little, according to my analyses: eleven samples gave 1·0 to 1·3 per cent. of these matters; Polish corn gives 1·5; Spanish, 1·8; and that of Tangarock, 1·9. These last results seem to confirm the generally received opinion that hard grains contain more fatty matters than soft grains—an opinion which is likewise supported by the analyses executed by MM. Dumas, Boussingault, and Payen, on the hard corns of Venezuela and Africa: the first contained 2·1 per cent., and the second 2·6 per cent. of fatty matters. However, I should remark that other hard or demi-hard corns, such as that of Egypt, and the *mitadin* of the *South*, furnished only 1·1 per cent. of these matters; whilst, in the opposite direction, the white touselle of Brie contains, according to M. Payen, 1·87 per cent. I am so much the less convinced that this difference really exists between the soft and hard grains, as it is certain that unscrupulous dealers sometimes impregnate their corn with oil, in order to give it a

glaze, which renders it more saleable. This kind of deceiving is also used for other grains, especially for that of trefoil. I may add that the corns which gave the largest proportion of fatty matter were brought in commerce, whilst the others had a very authentic origin, since they were obtained from the grounds of M. L. Vilmorin.

SUBSTANCES SOLUBLE IN WATER.

In the number of substances which cereals abandon when treated by water, sugar, or rather glucose, has lately been ranked. According to Vanquelin, the farina of a soft Odessa corn contains 8·5 of saccharine matter, and all the farinas which he analysed contained considerable quantities of it. The theory of panary fermentation very readily agrees with the existence of sugar in the farina; for it is admitted that it is under the influence of the transformation of this sugar into alcohol and carbonic acid that the farina rises, when it is made into a paste with water, barm or beer yeast.

Several years ago, on the occasion of the saccharimetrical process which I communicated to the Academy, I endeavored to estimate the quantity of glucose which might be presumed to exist in the cereals, and I was much surprised at finding none in either wheat or oats. It is known that my process consists in determining by an alkalimetrical test the quantity of slaked lime which is dissolved by a saccharine liquor, which quantity is proportional to the weight of sugar contained in that liquor. By treating with water 200 grammes of these farinas, obtained from grain ground in my own presence, then adding slaked lime to the solution previously placed on a sand-bath, the lime was not dissolved in larger quantity than in pure water. Moreover, these solutions did not ferment when beer yeast was added. Besides, M. Clerget examined, at my request, by means of the phenomena of polarisation discovered by M. Biot, a portion of the liquor arising from the washing of a farina which I studied in my way; he could not detect the presence of glucose; he only proved that these liquors contained dextrine.

Now, wheat and oats do not contain glucose; Mitscherlich and Furstenburg arrived at the same result, by employing other methods, with rye and wheat bran. Although these experiments, which were made with fresh ground wheat, do not absolutely prove that glucose does not exist, either in farinas kept for a long time, or in damaged farinas, I am led to believe that panary fermentation may be developed without an appreciable quantity of glucose pre-existing in the farinaceous paste; I have proved, indeed, that a paste prepared with 125 grammes of fresh farina, 75 grammes of water, and 10 grammes of beer yeast, does not contain any appreciable quantity of glucose, when it is examined whilst rising. It is possible that the dextrine may be directly converted into alcohol and carbonic acid, or else that its passage to the state of sugar cannot be proved, the sugar being destroyed by the yeast as fast as it is produced.

As to the existence of dextrine, it is beyond doubt; it is rendered evident by the employment of the polarisation apparatus; it is, moreover, proved by its passage to the state of glucose by means of steam driven into the liquid resulting from the washing of the farina, to which liquid a few drops of sulphuric acid had been added. Finally, its existence may also be deduced from the old experiments of Vanquelin, who proved that gum, which is ranked among the principles of farina, should be erased from this number, seeing that this pretended gum, treated by nitric acid, furnishes oxalic acid, but not mucic acid.

At the same time that water dissolves the dextrine contained in farina, that liquid separates a nitrogenous matter, which presents all the characters of albumen The proportion of that matter had not yet been determined. To fill up this gap, I analysed the liquid resulting from a known weight of corn, already deprived of its fatty matter, by evaporating at a gentle heat, and then drying the residue at 230° F., which, being weighed, gives the proportion of soluble matters contained in the corn; finally, by determining the quantity of nitrogen contained in this residue. I have admitted, with MM. Dumas and Cahours, that this albumen, like the other nitrogenous matter of old corn, contains 16 per cent. of nitrogen. It was on this basis that I calculated my analyses. As it would have been very tedious to determine for each kind of corn the proportion of nitrogenous matter contained in the soluble products, I made this operation on a certain number of samples of hard and soft grains; and having found that this proportion, which varies very little, represents, on the average, one-fifth of the weight of these products, I subtracted from the soluble products, which were always determined for each corn, one-fifth of their weight, which I attributed to the albumen.

(To be continued)

ON THE NITROGURET OF BORON.*

BY PROFESSOR WOHLER.

Mr. Balmain discovered, eight years ago, a combination of boron with nitrogen, to

* *Annales de Chimie et de Physique.* June, 1850.

which he gave the name of *æthrogen*, a name analogous to that of cyanogen, taking as a basis a property which he thought he discovered in this body, of forming, like cyanogen, combinations with the metals. He afterwards perceived that all the substances described by him as æthonides were one and the same substance—nitroguret of boron—and that they did not really contain any considerable quantity of metal. He obtained this compound by heating a mixture of boracic acid and cyanide of potassium, cyanide of zinc, cyanide of mercury and sulphur. I have found that it may be very well obtained by calcining a very dry mixture of borax and ferrocyanide of potassium.

Having observed that nitroguret of tungsten is formed when tungstate of potassa is heated with sal ammoniac, I thought that nitroguret of boron might be formed by the same means. My experiments have entirely answered my expectation. I have thus obtained a body which possesses all the properties of the compound produced by Mr. Balmain by means of the cyanides, and of which, as I shall show further on, the formula is

BN,

and may, consequently, by the action of water, be converted into boracic acid and ammonia.

To produce the nitroguret of boron by this method, 1 part of pure and perfectly dry borax is intimately mixed with 2 parts of dried sal ammoniac; a porcelain, or, better still, a platinum crucible is filled with this mixture, covered with a lid, and heated to bright redness.

The earthen crucibles commonly employed in chemistry are less suitable in this case, because chloride of iron is formed, and the product then contains iron. To obtain small quantities of nitroguret of boron, we may operate in glass. A white, porous, infusible mass is obtained, which is ground to a fine powder, and which is boiled for a long time with a large quantity of water to which a little hydrochloric acid is added.* The nitroguret of boron separates under the form of a white powder, which is evaporated by filtration, washed with warm water and filtered.

When nitroguret of boron is prepared in an earthen crucible, or with borax which has not been purified by several crystallisations, in order to free it from foreign matters, it is necessary to digest it with concentrated hydrochloric acid, and even then we do not always succeed in obtaining it perfectly pure. Thus obtained, nitroguret of boron forms a perfectly white, very light powder, which, even when magnified to 500 times its bulk, still presents the appearance of a perfectly amorphous, granular mass, of a milky white. Rubbed on the skin, it resembles talc, and gives it a great polish. It possesses all the characteristic properties described by Mr. Balmain: heated before the blowpipe, it gives a brilliant flame of a greenish white; it developes a large quantity of ammonia by its fusion with hydrate of potassa, and resists the action of the concentrated acids and alkalies: calcination in a current of hydrogen or chlorine does not cause it to undergo any change. In a current of steam, under the influence of a moderate temperature, it is completely converted into ammonia and boracic acid. As the latter is in great part carried away by the steam, this steam, in condensing, gives a solution of borate of ammonia.

Moreover, I have also observed the following facts.

Nitroguret of boron, introduced into a porcelain crucible, surrounded with powdered charcoal, and placed within an earthen crucible, and then subjected to a temperature sufficient to fuse nickel, underwent no modification: it gave no indication of fusion, and lost no nitrogen.

Under the action of a jet of oxygen directed into the flame of a spirit lamp, it burns promptly, with a weak flame of a greenish white, giving rise to boracic acid. However, it cannot be carried to incandescence when heated to bright redness in a small platinum crucible, into which oxygen gas is directed. Nitroguret of boron does not give a flame in this case, although it is generally endowed with the remarkable property of giving a greenish white flame, more brilliant than that of any other body, a property which appears only by its contact with the external part of a flame, which always supposes an oxidation, although it is extremely slow. Nitroguret of boron, calcined in a current of chlorine gas, appeared to me to give a very vivid light, which is not produced when it contains foreign matters.

Nitroguret of boron possesses the very remarkable property of reducing with heat the easily reducible metallic oxides without producing the phenomena of incandescence, and of giving binoxide of nitrogen and nitrous acid. If, indeed, it be heated in a

* Pure water is at first employed, which, by slow evaporation, allows common salt to deposit in well-formed transparent octohedra. By heat, these octohedra become of a milky white, without losing their form or their lustre. Their aqueous solution reproduces cubes.

glass tube with oxide of lead, oxide of copper, or oxide of mercury, the tube is filled with thick red vapors.

Exposed to a temperature of 392° F. in presence of water in a sealed tube, it forms ammonia and boracic acid; the metamorphosis is only very slowly effected at this temperature. If the action be allowed to continue for several hours, and if the tube does not explode, the glass is powerfully attacked, and changed into a white opalescent substance; the water then contains potassa, silica, boracic acid and free ammonia.

Concentrated sulphuric acid, even with the aid of heat, has no action on nitroguret of boron, if these two bodies remain for a short time in contact; but if the contact be prolonged, and if the acid be heated to its boiling point, the nitroguret of boron is converted into boracic acid and ammonia. If it be digested with fuming hydrofluoric acid, it is still more easily decomposed, and a large quantity of fluoborate of ammonia is formed.

The most remarkable property of nitroguret of boron is that which it presents by calcination with anhydrous carbonate of potassa. It is thus changed into borate of potassa and cyanate of potassa; it consequently decomposes carbonic acid, and reduces it to the state of a carbon, which combines with the nitrogen and forms cyanogen: this certainly unexpected formation of cyanogen is in accordance with the observation of Berzelius, that free boron heated with carbonate of potassa is oxidised at the expense of the carbonic acid, and reduces it to carbon. 1 equivalent of nitroguret of boron and 2 equivalents of carbonate of potassa ($BN+2PO\,CO^2$) contain the same elements in the same quantity as 1 equivalent of borate of potassa and 1 equivalent of cyanate of potassa (PO, BO^3+PO, C^2NO). This curious decomposition is produced with the greatest facility, even at a low temperature, in a platinum crucible heated in a spirit lamp. A mixture of nitroguret of boron and dry carbonate of potassa in the above-mentioned equivalent proportions (3 : 17), heated, fuses easily at a temperature at which carbonate of potassa by itself would not fuse, and is converted into a transparent liquid which, by cooling, assumes the form of a white crystalline mass. This mass is formed of equal parts of borate of potassa and cyanate of potassa, and forms with water a clear solution. This cyanate of potassa I used for the preparation of pure crystallised urea, and afterwards crystallised cyanuric acid.

If an excess of nitroguret of boron be employed, there is also formed much cyanide of potassium, by means of which I produced Prussian blue and hydrocyanic acid.

Nitroguret of boron heated to bright red, in presence of carbonic acid, in a porcelain capsule, is not decomposed. As regards the direct proof of the composition of nitroguret of boron, analyses of substances arising from different preparations gave very different results, and have led to this conclusion: that this body, when it has not been prepared with the greatest care, does not present an uniform composition, and retains extraneous substances, and chiefly boracic acid which it is very difficult to remove from it. I do not lay much stress on this circumstance, because it had not much utility, and I have given only the results which were obtained with a substance carefully prepared, although by different methods, and which might give results capable of comparison.

The facility with which nitroguret of boron forms ammonia under the influence of the hydrates, renders the determination of the nitrogen very easy. It is determined, as with an organic substance, by calcination with a mixture of hydrate of lime and soda, to which, in order to render it more fusible, a little more hydrate of soda than usual is added.

Four analyses, made by Dr. Stadeler, with substance prepared by different means, gave 48·13, 49·63, 50·77 and 51·86 per cent. of nitrogen. The nitroguret of boron employed in the last analysis, which gave 51·86 per cent. of nitrogen, was treated with hydrofluoric acid: 0·8289 gr. gave 2·8363 grs. of ammoniacal salt of platinum.

For the direct determination of the boron, there was only one means—oxidation with heat by a determined weight of nitrate of lead. That which the residue of the fusion contained, besides oxide of lead, can be only boracic acid. This method, which may be used in many other cases, is very quick and easy of execution: it gives, in my opinion, certain results. The salt employed should be perfectly pure, and reduced to very fine powder. As it is easily decomposed at a moderate temperature, it must be dried with caution. The fusion may be effected in a platinum crucible when a great excess of salt is employed; if too little be used, the lead is reduced, and alloys with the platinum. The mixture of the substance to be oxidised with the salt is effected in the crucible by means of a sufficiently thick platinum wire; it should be done with care. As the mixture swells up very considerably, it must be cautiously heated at the commencement: it is finally heated for a few minutes until the mass is in tranquil fusion.

0·180 gr. of nitroguret of boron, treated by hydrofluoric acid, dried at 300° F., fused with 6·068 of nitrate of lead, gave 4·34 of fused residue. If we deduct 4·088 oxide of lead contained in the salt, there remains 0·246 of boracic acid containing 0·0768 of boron, or 42·66 per cent. nitroguret of boron. A second analysis gave 42·23.

Five other analyses, made with nitroguret of boron resulting from three different preparations gave 41·93, 41·61, 40·88, 40·87 and 40·38 per cent. of boron.

If we regard as most correct the highest numbers found for the nitrogen and boron, we obtain, in 100 parts :—

Boron	42·66
Nitrogen	51·96
Loss	5·38

This loss can be only oxygen, and this oxygen can exist in the combination only under the form of boracic acid ; for this compound contains, as careful investigation has proved to me, neither chlorine nor sodium. Brought into equivalents, this composition in 100 parts corresponds to a combination of 1 equivalent of boracic acid with 14 equivalents of nitroguret of boron (BO^3 +14BN), which contain

Boron	42·617
Nitrogen	51·124
Oxygen	6·259
	100·000

A compound, in such proportions, is improbable. It appears much more probable that the boracic acid in variable quantity contained in the nitroguret of boron, is a consequence of the properties of the latter, of its amorphous and entirely infusible state: that boracic acid exists in it only in the state of mixture, and that it is mechanically interposed between the molecules, from which it cannot be separated by washing, or by means of the ordinary solvents: it is thus that sugar mixed with boracic acid and calcined gives a charcoal from which all the boracic acid cannot be extracted by means of solvents.

Pure nitroguret of boron, BN, free from boracic acid, which has never been prepared, unless Mr. Balmain obtained it in his experiments, has not yet been analysed in this state : it should contain, in 100 parts :—

Boron	43·76
Nitrogen	56·24
	100·00

ON THE ACTION OF CHLORINE ON THE METALLIC CHLORIDES IN PRESENCE OF THE ALKALINE CHLORIDES.*

BY SIGNORI SOBRERO AND SELMI.

The metallic chlorides to which we have in preference directed our investigations are the protochloride of manganese MnCl, and protochloride of lead PbCl. Some other chlorides were submitted to experiment, but the results which we obtained were far from being clear; we have therefore deferred speaking of them until a future occasion.

CHLORIDE AND PROTOCHLORIDE OF MANGANESE WITH THE ALKALINE CHLORIDES.

It is well known that the protochloride of manganese, in solution in water, is not altered when submitted to the action of chlorine gas. This is not the case when the solution of protochloride of manganese contains an alkaline chloride (of potassium, sodium, calcium, &c.) Chlorine exerts, in this case, a very prompt action, for it no sooner comes in contact with this salt, than it decomposes it, producing a precipitate of binoxide of manganese. The experiment may be made by driving a current of chlorine gas into a solution of very pure chloride of sodium or potassium, containing a few drops of a solution of protochloride of manganese, or else by adding the solution of this metallic chloride to the solution of the alkaline chloride, previously saturated with chlorine. This reaction takes place without the assistance of the solar light; our experiments were in fact always performed with liquids charged with chlorine in the dark.

M. Millon† has published a process by means of which we can discover whether water saturated with chlorine has been exposed to the direct action of the solar light; in chloruretted water thus modified, there exists at the same time hydrochloric acid and hypochlorous acid, and if protochloride of manganese be added to it, it is immediately decomposed and binoxide is precipitated. The reagent is very delicate and capable of detecting very minute traces of hypochlorous acid.

We have repeated M. Millon's experiments, and we are convinced that his test is very good in the cases in which the water does not contain alkaline chlorides ; and that if it contains even small quantities

* Read before the Academy of Sciences at Turin.

† *L'Institut*, 24 Jan., 1849.

of these salts, it is rendered turbid by the protochloride of manganese, even although it has not undergone the action of the solar rays; it is therefore a necessary precaution, before using M. Millon's test, to ascertain that the chloruretted water is free from alkaline chlorides.

CHLORINE AND PROTOCHLORIDE OF LEAD WITH ALKALINE CHLORIDES.

M. Millon has observed that the protochloride of lead is an excellent test for detecting the presence of hypochlorous acid, and particularly if chloruretted water has been exposed to the rays of the sun; for, in this case, the protochloride of lead is immediately decomposed and pure oxide is precipitated. We were led, by the foregoing experiments to investigate whether the presence of alkaline chlorides would not exert on chloride of lead an action analogous to that which it exerts on the protochloride of manganese. Our investigations have proved that in this case things occur very differently from the former.

When a solution of chlorine in water containing one or more alkaline chlorides has not undergone the action of the direct rays of the solar light, the protochloride of lead does not produce in it any precipitate of binoxide. This metallic salt, naturally very sparingly soluble and perfectly colorless, is dissolved in the chloruretted liquor in considerable proportion, and causes in it a very evident canary yellow color.

Let a saturated solution of chloride of sodium be made without heat; add to it a small quantity of protochloride of lead, then drive into it a current of washed chlorine; immediately after the first bubbles of gas, the yellow chloride appears quite different from that which chlorine produces in dissolving in water. By continuing the operation, it is evident that the protochloride of lead dissolves and entirely disappears, if after some time a second and third quantity be added, which will wholly or partially dissolve: whilst the yellow color of the liquor will become deeper and deeper, still retaining its canary yellow tint. The absorption of chlorine gas during this operation is very evident, contrary to what is known of the solubility of this gas in solutions of the alkaline chlorides. We thus come to a point at which the solution of the protochloride of lead and the absorption of the chlorine gas entirely cease. The liquor may then be left to repose, and decanted into flasks well closed with ground stoppers, in which it may be kept for any length of time.

The following are the properties and reactions of this liquid:—it has a deep yellow color, and its odor is that of a strong solution of chlorine: in a well-closed vessel, it may be kept very well, and is not altered although exposed to the direct action of the luminous rays (it does not give a precipitate of binoxide of lead.) In an open vessel, it loses its chlorine, and deposits protochloride of lead. If it be poured drop by drop into a large quantity of water there is immediately obtained a precipitate of binoxide of lead mixed with protochloride, in proportions varying according to the quantity of water employed.

When a caustic alkali is added to this yellow liquid, binoxide of lead is precipitated, which may be obtained very pure by several washings in warm water. Carbonate of lime produces in this yellow liquid a brisk effervescence with an immediate precipitation of binoxide of lead. Carbonate of potassa causes in it a light brown precipitate whose formation is not always accompanied with a disengagement of carbonic acid: this precipitate is decomposed by washing and exposure to the air, becomes deeper in color, and is converted into binoxide of lead: thus, it appears that there is formed in this decomposition carbonate of binoxide of lead, a very unstable compound, from which carbonic acid is very readily disengaged. Phosphate of soda also causes in it a light brown precipitate, which is probably phosphate of binoxide of lead, and which is not more stable than the carbonate, for simple washings in cold water convert it into binoxide of lead.

If to the yellow liquid be added a little protochloride of manganese, a precipitate of binoxide of manganese is immediately obtained, as in the solutions of chlorine mixed with alkaline chlorides; protochloride of lead is at the same time deposited.

The action of this yellow liquid on the metals is striking from its energy, which might be compared to that of aqua regia. Thus copper, iron, zinc, &c., are promptly attacked and converted into chlorides, whilst protochloride of lead is precipitated. Gold in fine leaves, and platinum in fine powder, dissolve with the greatest facility.

Organic matters are profoundly altered by contact with this liquid: all precipitate from it protochloride of lead, giving the products of their oxidation or chloridation. Oxalic acid presents the most energetic phenomena of oxidation. Thus, when the yellow liquid was mixed with a solution of oxalic acid, the mixture immediately pre-

sented a brisk effervescence owing to a very powerful disengagement of carbonic acid gas.

Urea presents analogous phenomena &c., &c. These reactions are all accompanied by precipitation of protochloride of lead. The salts of quinine and morphia precipitate the yellow solution; the precipitate is yellowish white; washings with water decompose it and convert it into pure oxide.

What is the nature of the chloruretted compound whose history we have sketched? The facts ascertained lead us to think that it acts as a bichloride of lead, which would consequently be composed according to the formula

$PbCl^2$ (in equivalents),

similar to the binoxide PbO^2. This bichloride would be however a rather unstable compound, and would be formed only in presence of the alkaline chlorides, with which it would be combined perhaps playing the part of an acid. This compound, which is very soluble, cannot be obtained isolated either by evaporation or by cooling. Owing to the impossibility of analysing it in the pure and isolated state, we determined, in the yellow liquid which we had prepared by means of chloride of sodium, the relative proportions of lead, chlorine and sodium. It may be believed that this latter metal exists in the compound only in the state of chloride; thus subtracting from the total quantity of chlorine that which is in combination with the sodium, we thought we could determine, very nearly, the relation between the lead and the chlorine which were combined in it. Our analyses led us to numbers which correspond to the following composition:—

	O=8	O=100
1 equiv. lead	104	1294
$6\frac{1}{2}$ „ chlorine ...	234	2879·5
$4\frac{1}{2}$ „ sodium	108	1291·0

or, doubling the number of equivalents, lead 2 equivs., chlorine, 13 equivs., sodium, 9 equivs.; perhaps the formula of the double salt is

$$2PbCl^2+9SoCl^2,$$

We think we have discovered from our experiments that lead is capable of forming a bichloride $PbCl^2$, which corresponds with the binoxide, and which is a new fact in the history of lead; and that this compound is formed in the presence of the alkaline chlorides by the combination of chlorine with the protochloride.

Finally, we think that, to prepare the peroxide of lead for use in the laboratory, it will often be convenient to use the protochloride of lead mixed with a solution of chloride of sodium or other alkaline chloride, subjecting it to a current of gaseous chlorine, continued until no more can be taken up, precipitating afterwards by an alkaline liquid, and washing the precipitate with a large quantity of water. This method will be, at least in some cases, quite as convenient as that which consists in treating minium by nitric acid.

ON THE EXTRACTION OF IODINE FROM PLANTS AND FROM THE PRODUCTS OF THE DISTILLATION OF COAL.*

BY M. BUSSY.

At the last sitting of the Academy, some doubts were expressed concerning the correctness of the facts adduced with the object of demonstrating the existence of iodine in certain plants.

One of our honorable colleagues announced that he had not been able, by means of a very perfect process, to detect in cress the characteristic reactions of iodine.

I have the honor of presenting to the Academy a portion of the cress on which I operated, and by means of which the reactions of iodine may be obtained by employing, either M. Alvaro Reynoso's process (see The Chemist, new series, No. I., Oct., 1849, page 15), or any other method known to chemists.

Besides this sample I present a portion of the liquid containing the iodide of potassium extracted from the same plant.

This liquid was obtained by operating on a weight of matter equal to the sample itself.

Five or six drops will suffice for producing in an unequivocal manner the reactions of iodine.

The second sample is a plant which I consider richer in iodine than the first. It is a ceratophyllum gathered in the little water courses in the neighbourhood of the pool of Ville-d'Avray.

The bottle which accompanies it contains, in solution, the iodide of potassium extracted from 100 grammes of this plant dried; the reactions which this solution gives are extremely distinct, and I doubt not but M. Chatin, who discovered iodine in this plant, who found it, after Muller, in cress, will be able, when he pleases, to completely isolate this simple body and to present samples to the Academy. This is a task which I ought to allow him the satisfaction of fulfilling.

* *Comptes Rendus*, No. 18, May 6, 1850.

The experiments to which I devoted myself on the occasion of M. Chatin's memoir, recalled my attention to a fact which I observed in 1839; the existence of iodine in the coal of Commentry.

This coal is, in some parts, very much charged with sulphuret of iron, whence it very often results that the masses, in working, enter into a kind of slow combustion. The heat produced in this case gives rise to thick vapors which condense on the surface of the ground or on the edges of fissures communicating with the interior.

Among the condensed products we find sulphurets of arsenic and other arsenical compounds; much sal-ammoniac is also met with. It was in the latter that I detected the presence of hydriodate of ammonia. But, at that period, I confined myself to the reactions demonstrating the presence of iodine, without seeking to isolate it.

The observations which were addressed to me at the last sitting have induced me to verify this fact and to extract the iodine from the coal.

Not having at hand the natural product in which I first met with it, I had recourse to the product of the artificial distillation of the coal, as obtained at gas works. I therefore procured a certain quantity of ammoniacal liquid resulting from the condensation of the aqueous vapors which accompany the gas when it issues from the retort: I found in it a considerable quantity of iodine which I have been able to isolate and estimate.

The process which I adopted consists in adding, to a given quantity of liquid, pure potassa, in order to convert into iodide of potassium the iodine which must exist in it in the state of hydriodrate of ammonia, in evaporating to dryness, calcining to destroy all the tar, and in treating the residue with rectified alcohol which dissolves the iodide of potassium.

The iodine was estimated by means of iodide of palladium, and it was by the decomposition of this salt that I obtained the iodine of which I have the honor of presenting a sample to the Academy.

3·700 kil. of gas liquor, for which I am indebted to the kindness of the director of the gas-works of the *barrière* Fontainebleau, gave 0·59 gr. of iodine; this is nearly 0·16 gr. per kilogramme.

I tested in the same manner the gas-liquor with which the director of the French gas-works of the Faubourg Poissonnière was so kind as to furnish me; I also found iodine, which renders it very probable that it will be found in many other kinds of coal.

I should observe that this proportion of iodine does not represent the whole quantity that the coal contained; a considerable proportion remains in the coke, and may be extracted from it by incineration.*

Thus, 2 kilogrammes of ashes resulting from the combustion of coke give, when treated by water, as has been stated above with regard to the ashes of plants, the characteristic reactions of iodine.

The considerable quantities of coal which are daily distilled for the preparation of lighting gas, permit the hope that we may be able to obtain the iodine which gas liquor contains, especially if we are enabled to effect the extraction of this simple body without interfering with the preparation of the ammoniacal products which are now extracted from this liquor.

ON A NEW COMBINATION OF SULPHUR, CHLORINE, AND OXYGEN.

BY M. E. MILLON.†

In seeking to produce a degree of chloridation of sulphur superior to that which has been obtained, SCl, I remarked several years ago, the formation of a crystalline product which I supposed to be formed only of sulphur and chlorine.

But in reproducing this compound several times, I finally discovered that it was formed only when the chlorine was slightly humid and in great excess. From this moment, I suspected the presence of oxygen; by the aid of a peculiar method of preparation, I was enabled to obtain this product in very considerable quantity; I then resumed the analysis, and proved in it, besides a large proportion of oxygen, certain properties of isomeric transformation very rare among mineral compounds.

This new compound is immediately obtained by dropping a few drops of chloride of sulphur into a flask imperfectly dried and containing chlorine moistened by its passage into a washing flask. Too great a quantity of moisture would instantaneously destroy this compound, or prevent its production. But in the circumstances which have just been indicated, the flask is speedily covered with transparent colorless crystals, which fix on the sides. We cannot, however, detach the compound,

* M. Chatin has also proved the presence of iodine in coal ashes.

† *Annales de Chimie et de Physique*, June, 1850.

thus displayed in thin layers, which damp air rapidly destroys. To prepare the compound in sufficient quantity and submit it to experiments, we proceed differently.

Into a flask of 4 or 5 litres capacity filled with humid chlorine, we introduce from 20 to 30 grammes of chloride of sulphur, already saturated with chlorine, and afterwards 2 or 3 grammes of water. We agitate and then surround the flask with a refrigerating mixture of ice and common salt for 4 or 5 hours. A considerable disengagement of hydrochloric acid takes place; the flask is again filled with humid chlorine, and replaced in the frigorific mixture: this series of operations is renewed until the chloride of sulphur becomes an abundant crystalline mass, in an excess of chloride of sulphur. This formation of crystals arranged sometimes in fine needles, and sometimes in large rhomboidal plates, is ordinarily preceded by the appearance of a yellowish liquid, heavier than chloride of sulphur, from which it separates like an oil.

When the crystals are thus obtained, extreme difficulty is experienced in separating them from the chloride of sulphur which impregnates them, and from a little sulphuric acid which is formed. It is effected only by passing into the flask, for 10 or 12 hours, a current of chlorine dried over sulphuric acid. At the same time that the dry chlorine traverses the flask, the crystals are volatilised by making them pass, by means of burning charcoal, from one side of the glass to the other. Notwithstanding this tedious operation, the crystals always retain traces of chloride of sulphur and of sulphuric acid which analysis detects in them.

It is almost impossible to analyse these crystals immediately after their production; they are, indeed, destroyed with extreme violence, which throws them about in every direction as soon as they touch water, alcohol, or dilute acids. But I availed myself, for determining their composition, of the following very interesting property. When the crystals are freed from chloride of sulphur as much as possible, they are dropped into a very dry glass tube, closed at one end, and the open end of which is immediately drawn to a point in a lamp; at the end of two or three months these crystals soften and become pasty, moisten, and after seven or eight months are converted into an extremely fluid liquid, of a slight yellow color, almost imperceptible when the current of chlorine has been maintained for a long time. No absorption takes place nor any division of the compound, which it is impossible to restore to the solid state, even by the application of a very low temperature.

It is therefore an isomeric transformation which is shown not only by the change of physical properties, but also by the change of chemical properties. Thus, the liquid on being thrown into water does not cause the hissing sound which the crystals produce; it may be treated by dilute acids, alcohol and water, at the bottom of which it is quietly deposited under the form of an oil, which, after a long time, is completely changed into sulphuric, sulphurous, and hydrochloric acids.

This transformation is in perfect accordance with its analysis, which leads us to represent it as a combination of sulphur, chlorine and oxygen, in these proportions:

$$S^2O^3Cl^2.$$

It is a different compound, as is evident, from the chlorosulphuric combination discovered by M. Regnault, SO^2Cl, and from the liquid analysed by H. Rose, and represented in its composition by

$$S^2O^3Cl.$$

As regards the analysis of the compound which I have described, and which may be designated under the name of *the hypochlorosulphuric* compound, it will be understood that it presents no difficulty when once it has assumed the liquid form. It is sufficient, indeed, to fill a weighed bulb with it, which is broken in a flask containing nitrous nitric acid. The violence of the reaction is moderated by cooling the flask; the sulphur is easily estimated in the state of sulphate of baryta, and the chlorine in the state of chloride of silver.

The theoretical composition indicates for $S^2O^3Cl^2$ the following proportions:—

	O=100	O8	In hundredths.
S^2.....	400·0	32	25·20
O^3.....	300·0	24	19·03
Cl^2.....	886·4	72	55·87
	1586·4	128	100·00

A first product, incompletely freed from chloride of sulphur and sulphuric acid, gave:—

	In hundredths.
Sulphur	27·05
Chlorine.....	54·06

A second product, arising from crystals several times volatilised in a current of very dry chlorine, furnished:—

	In hundredths.
Sulphur.....	26·13
Chlorine.....	55·02

It is impossible to reconcile with these numbers any other formula than that which has been above indicated.

ON PAPAVERINE.*

BY MR. GEORGE MERCK.

SOME time ago, Mr. G. Merck announced that he had extracted from opium a different base from those hitherto met with in it. To this new alkaloïd he gave the name of *papaverine*. To extract it from opium, he at first employed the following process:—

An infusion of opium was precipitated by soda, and the deposit, principally formed of morphia, was exhausted by ordinary alcohol. A brown tincture was thus obtained, which left by evaporation a deep-colored residue. This residue was treated by a weak acid, and the solution obtained, precipitated by ammonia, deposited a brown resinous mass, which contained much papaverine. When this resin was dissolved in hydrochloric acid, and the liquor treated by acetate of potassa, a high colored and resinous body was precipitated; this body, previously washed in water, was treated with boiling ether. On the cooling of the etherial solution, the papaverine separated in crystals.

Afterwards, Mr. Merck obtained this base by a more simple process. After having dried the resin in question on a sand-bath, it was treated by its weight of alcohol. It thus formed a pitchy mass which, left to itself for a few days at the temperature of 90° F., became a crystalline mass. This was powerfully pressed, and purified by treating with animal charcoal and crystallisation in alcohol.

Papaverine thus obtained is, however, mixed with narcotine. To purify it completely, it is treated with hydrochloric acid, and the hydrochlorate of papaverine is crystallised. As it is sparingly soluble in water, it is sufficient to wash the crystals with cold water to completely free them from narcotine.

Papaverine is deposited in alcohol under the form of irregularly agglomerated and colorless prismatic crystals. It is sparingly soluble in cold alcohol and in ether. With heat, it dissolves more easily, and crystallises in cooling. It is insoluble in water. Its solutions restore the blue color of reddened litmus. A characteristic reaction of papaverine is, to acquire a deep blue color when moistened with concentrated sulphuric acid.

The analyses of pure papaverine have led to the formula

$$C^{40}H^{21}NO^{8}.$$

HYDROCHLORATE OF PAPAVERINE.

Papaverine readily dissolves in concentrated hydrochloric acid, and is precipitated again from the solution, when an excess of acid is added, under the form of a heavy and thick liquid, which collects at the bottom of the vessel. When this liquor is left to itself, crystals are formed in it, as well in the aqueous part as in the oily liquid which is precipitated, and which finally forms a mass of bulky and regularly formed crystals. By redissolving these crystals in boiling water and leaving the solution to itself for some days, bulky and very pure crystals of hydrochlorate of papaverine are obtained. The composition of this salt is represented by the formula

$$C^{40}H^{21}NO^{8}HCl.$$

When a solution of this salt is mixed with a solution of chloride of platinum, a yellow precipitate is obtained, which is pulverulent and insoluble in water and alcohol.

This is a double combination of chloride of platinum and hydrochlorate of papaverine, which contains:—

$$C^{40}H^{21}NO^{8}, HCl + PtCl^{2}.$$

NITRATE OF PAPAVERINE.

This salt could not be prepared directly. The slightest excess of nitric acid colors the solution yellow. The nitrate of papaverine is obtained by decomposing a hot solution of hydrochlorate by nitrate of silver. The filtered liquor allowed nitrate of papaverine to deposit.

$$NHO^{6}, C^{40}H^{21}NO^{8}.$$

Mr. Merck has made various experiments for studying the action of papaverine on the animal economy. He has always found that this action is by no means comparable to that which most of the other alkaloïds exert. Very considerable quantities of papaverine may be swallowed without causing any peculiar symptoms.

The author concludes his memoir by describing the action which some oxidising reagents exert on papaverine.

When this base is boiled with a mixture of peroxide of manganese, sulphuric acid and water, the liquor becomes brown, and at the end of some hours, brown flakes separate, the study of which the author has not pursued.

Boiled with nitric acid of a moderate degree of concentration, papaverine becomes a yellow crystalline mass, which appears to be a nitric combination, containing the elements of NO^{4} substituted for one equivalent of hydrogen.

* *Annalen der Chemie und Pharmacie.*

EXTEMPORANEOUS PREPARATION OF CHLORATE OF BARYTES, WITH REMARKS ON ITS IMPORTANCE IN CHEMICAL INVESTIGATIONS.

BY M. DAMBERGER.

CHEMISTS will often have noticed that newly-discovered acids are most generally

found, in the first instance, along with potassa as a base, particularly those of organic origin. Now the effect of strong acids on these salts is, to cause a disruption of the elements of the new acid, so that it is often impossible to isolate the latter entire; this destructive effect, however, does not take place when the new acid is in union with an earthy base, and dilute sulphuric acid employed as the precipitant.

To form a barytic salt of the new acid, nothing can be easier, provided the resulting compound be *insoluble*: the case is widely different should it happen to be *soluble*. In the former case, the muriate or other cheap salt of baryta answers the purpose to perfection—in the latter, I should like very much to know what other salt but the chlorate* will effect the requisite transfer? The reaction would be as follows when we employ the chlorate:—

1(K, CHO) and 1 ($BaClO^3$)=1(K, ClO^3) and 1 (BaCHO).

The chlorate of baryta is best made on the large scale. To prepare it extemporaneously, the best plan is the following one:—3¾ lbs. of tartaric acid are dissolved in 3 gallons of water (kept at the boiling temperature), and carbonate of ammonia added gradually till the test-papers show the solution to be *perfectly neutral*, at which period you add 3¾ lbs. more of tartaric acid; you must next make a solution of 6 lbs. of chlorate of potassa in a gallon of boiling water in another vessel. Whilst both solutions are at the boiling temperature, they are to be rapidly mixed, stirring about with a stick three or four times. Bitartrate of potassa and chlorate of ammonia are the products of the reaction, and on cooling the mixture well, the chlorate is readily obtained by filtration. To produce the chlorate of baryta, you must boil a sufficiency of precipitated carbonate of baryta along with the filtered solution, and the carbonate of ammonia afterwards removed by means of wood naphtha or spirits of wine, in which the pure chlorate of baryta will dissolve, leaving the ammoniacal salt behind. Perhaps the use of the spirit might be dispensed with: I have no doubt but that if the mixed solution be evaporated to dryness, and the dry mass heated to a temperature *below* 480° F., the salt of ammonia will be got rid of very readily: the heat must be kept carefully below 480°, for that is the point at which the chlorate of baryta suffers decomposition. This is a cleanly process, and free from noxious fumes and deleterious gases.

Those ifiterested in the manufacture of this beautiful salt, as an article of commerce, on the large scale, I refer to a paper on the chlorates, inserted in THE CHEMIST at page 256, containing much valuable information on the subject. There is no chemical salt that brings more profit to the manufacturer than the chlorate of baryta: it is charged at the rate of 5s. per ounce at present! I think 6d. an ounce would afford an excellent remuneration--four sovereigns a pound is rather too much. It is astonishing that it is not made in much larger quantity than a few pounds at one time—let it be made by hundred-weights at once, and I will warrant a low price, good profit, and large demand.

* There is but one other—it is the perchlorate; it will cost, however, about nine or ten times the price of the ordinary or simple chlorate.—*M. D.*

ON THE ALCOHATE AND NITRATES OF MAGNESIA.*

BY A. CHODNEW.

IN the year 1827, Professor Graham called the attention of chemists to a remarkable group of compounds, which, on account of their analogy with the hydrates, he called alcohates. According to his opinion, absolute alcohol possessed the property of forming, with some anhydrous salts, combinations in which alcohol supplied the place of the water of crystallisation; and, although the idea of the substitution of alcohol for water, equivalent for equivalent, is not comprised within the term alochate, still it may be regarded as the most suitable for these compounds, in the examination of which I came to the following conclusions:

1. The hexhydrated nitrate of magnesia does not crystallise, as Einbrodt says, in very long parallelopidons with a perfectly square base; but it forms, as has long been known, rhombic prisms, among which, as I have convinced myself, other derived crystalline forms of the prismatic system are met with.

2. The hexhydrated nitrate of magnesia is, contrary to Einbrodt's stutements, a very deliquescent salt.

3. The monohydrated nitrate of magnesia is easily formed, as has been already proved by Professor Graham, and Einbrodt's contrary opinion is thus refuted.

4. The formation of anhydrous nitrate of magnesia is likewise not difficult, although it cannot be obtained without adding some basic salt. This circumstance is not, how-

* *Annalen der Chemie und Pharmacie*, and *Chem. Gaz.*

ever, prejudicial to the formation of the alcohate of the nitrate of magnesia. The existence of the anhydrous salt was consequently erroneously rejected by Einbrodt.

5. Over sulphuric acid, the hexhydrated nitrate of magnesia loses 4 atoms of water, and the bihydrated salt remains.

6. If the anhydrous nitrate of magnesia be decomposed by heat, a triple basic salt is first obtained, which is ultimately decomposed into nitric acid (nitrous acid and oxygen) and magnesia.

7. The old opinion of Fourcroy concerning the existence of the double salt of nitrate of magnesia and nitrate of ammonia, must be given up.

8. Anhydrous nitrate of magnesia forms with alcohol a combination, an alcohate, which consists of 3 atoms of alcohol and 1 atom of anhydrous nitrate of magnesia. It is very likely that there exists also a compound of nitrate of magnesia, alcohol and water.

9. Anhydrous chloride of calcium, dissolved in nearly anhydrous alcohol, forms an alcohate, which is composed of 2 atoms of alcohol and 1 atom of anhydrous chloride of calcium. It may also with great probability be presumed that there also exists another alcohate of the chloride of calcium, consisting of 3 atoms of the chloride of calcium, 2 atoms of alcohol, and 2 atoms of water: consequently,

10. The compounds discovered by Graham, and by him denominated alcohates, are not mechanical mixtures, but real chemical compounds. It is, indeed, true that he has given no explicit analysis of them, and thus afforded room for doubting the correctness of their composition; but this constituted no reason why the existence of these interesting compounds should have been denied, without a single experiment being made to investigate the accuracy of Professor Graham's statements.

ON BRONGNIARDITE, A NEW MINERAL.*

BY M. DAMOUR.

M. CASTLENAU, during his last journey in America, collected many mineral substances, which he confided to M. Damour to examine. Among these minerals, was a large specimen, possessing metallic lustre, and described as an ore of silver. As it did not possess any trace of crystallisation, it was only by analysis that it could be ascertained to be a distinct species, consisting essentially of sulphur, antimony, lead and silver. Its principal characters are the following:—

It has the metallic lustre peculiar to the antimonio-sulphurets, such as polybasite, bournonite, zinkenite, &c. Its fracture is uneven, and it has no cleavage. Its powder is blackish-grey. It scratches calcspar, and is scratched by a steel point. Its density is 5·950. When heated on charcoal, it decrepitates, and quickly fuses at a temperature below redness, emitting a sulphurous odor and white vapors. After long continued roasting, it leaves a globule of silver surrounded by a yellow aureola, indicating the presence of oxide of lead. When heated in a close glass tube, it decrepitates, fuses, and yields a small orange-red sublimate, surmounted by a white sublimate. If heated in an open glass tube, it decrepitates, fuses, disengages a strong sulphurous odor, and a white sublimate, peroxide of antimony, is deposited on the sides of the tube. Concentrated nitric acid attacks it rapidly, evolving nitrous vapors; the silver dissolves, and a residue is left, formed of sulphur, oxide of antimony and sulphate of lead. Nitric acid, diluted with four times its bulk of water, attacks it slowly, evolving sulphuretted hydrogen; the silver and lead are partially dissolved; a grey deposit in small needles remains, which consists of sulphuret and oxide of antimony, containing a considerable portion of lead and sulphur.

Concentrated and boiling hydrochloric acid dissolves this substance, evolving sulphuretted hydrogen. On cooling, the solution becomes turbid, and deposits chloride of silver mixed with chloride of lead.

A boiling solution of caustic potassa attacks this mineral when finely powdered. It thus dissolves a large quantity of sulphuret of antimony; a black heavy powder remains, which consists of sulphuret of silver and lead containing some antimony.

If sulphur be added to the potassa solution, the greater part of the antimony may be separated by successive decantations; the author, however, never succeeded by this method in separating the sulphurets of lead and silver perfectly from the sulphuret of antimony.

The analysis of the mineral was performed by acting upon it with a current of dry chlorine, in the manner described by Prof. Rose. The volatile chlorides of sulphur and antimony were separated, by exposure o a gentle heat, from the fixed chlorides of silver and lead. The sulphur was converted into sulphuric acid, and its quantity deduced from that of the sulphate of baryta which it yielded; the antimony was precipitated by sulphuretted hydrogen; the sul-

* *Annales des Mines*, vol. xvi., p. 227.

phuret obtained was analysed by the direct determination of the sulphur, and inferring the antimony.

The fixed chlorides were treated with boiling water, which dissolved the chloride of lead; the chloride of silver remained insoluble; its weight indicated the proportion of silver; the chloride of lead was converted into sulphate, and the weight of it gave that of the lead.

The liquor separated contained a minute portion of copper, iron and zinc, the quantity of which was ascertained by the usual processes.

The mean of three analyses gave:—

Sulphur	19·24
Antimony	29·77
Silver	24·77
Lead	24·91
Copper	00·62
Iron	00·26
Zinc	00·36
	99·93

The above results indicate the composition of the mineral to be:—5 equivalents of sulphur, 2 equivalents of antimnoy, 1 equivalent of silver, 1 equivalent of lead. In composition it approaches the *schilfglaserz* described in Dufrenoy's Mineralogy, containing, according to Wöhler:—

Sulphur	18·74
Antimony	27·38
Silver	22.93
Lead	30·27
	99·32

Considerable difference in the composition of these two substances, is, however, observable; the crystallographic characters of the *schilfglaserz* serve to distiuguish one from the other; in fact, the latter mineral crystallises in the system of the right rhombic prism, and gives well-marked cleavages; whilst the new mineral has a shining even fracture, without any indication of cleavage. It is to be expected, however, that it will at some time be found in regular crystals.

The specimen brought by M. Castelnau comes from the Mexican mines, and weighs about 14 lbs. One of its surfaces is sprinkled with iron pyrites. From its size and appearance it may be presumed to be a workable seam.

M. Damour suggests for this substance the name of bronguiardite, as a tribute of respect to the memory of the late M. Brongniart.

ON THE IODIDE OF CYANOGEN.

BY DR. HERZOG.

Dr. H. has made some additional experiments on the iodide of cyanogen which M. Klobach obtained in refining commercial iodine.

The iodide is in the form of colorless, slender, and flexible crystals, of a silky and vitreous lustre, and somewhat resembling caffeine. Its taste is very pungent; one of the fine crystals, on coming in contact with the tip of the tongue, causes a sensation similar to that produced by oil of mustard. It volatilises at 50° F.; it is sparingly soluble in cold, but very soluble in hot water, alcohol and ether. When dissolved in ether or in asbolute alcohol, some of the iodide, on evaporation crystallises in long and very beautiful needles, resembling a feather. It is soluble, without decomposition, at the ordinary temperature, in most of the acids, even in sulphuric, hydrochloric and nitric acids. An aqueous solution of chlorine does not decompose it, but the iodide of cyanogen dissolves in it, forming a perfectly colorless solution. A solution of this iodide in water, exerts no action on solutions of copper, iron, zinc, lead, silver, gold and platinum; but on being agitated with the metals, iodine is eliminated, iodides and small portions of cyanides being formed.*

At a high temperature, sulphuric and hydrochloric acids decompose it; nitric acid, even at the boiling temperature, produces no sensible change; the liquid remains colorless. A solution of ammonia dissolves it at first without alteration; the alcoholic solution soon gives crystals of the iodide of cyanogen and ammonia.

F. Meyer first noticed the occurrence of iodide of cyanogen in iodine, and that iodide of potassium prepared with that iodine might, occasionally, contain cyanide of potassium. In respect to this, the author states, that after treating iodine to which some iodide of cyanogen had been added, with metallic iron and water, some protocyanide of iron was found with the protiodide of iron in the solution formed, the former of which must have dissolved in the latter. If the iron be then separated by carbonate of potassa, even when some iodine containing iodide of cyanogen has

* M. Klobach, in subliming 80 lbs. of commercial iodine, perceived crystals of iodide of cyanogen in the first crop. He distilled it with mercury in order to separate the free iodine, and obtained 12 ounces of beautiful crystals of this iodide.

been added, cyanogen can no longer be detected in the liquid; cyanide of iron is, therefore, contained in the precipitate. Consequently, when iodide of potassium is prepared according to the directions of the Hanoverian or the old Prussian Pharmacopœia, with potassa, the iodine used containing iodide of cyanogen, cyanide of potassium is contained in the salt; but when it is prepared by means of iodide of iron, as ordered in the Hessian or new Prussian Pharmacopœia, it is free from cyanide of potassium.

The author found this salt to contain from 81·87 to 82·90 per cent. of iodine.

OBSERVATIONS ON SPONGY LEAD.*

BY M. BOLLEY.

THE author obtains spongy lead very easily in the following manner:—A smooth plate of zinc is coated with a thick paste of sulphate of lead and water about one inch deep. This is now placed in a vessel filled with a solution of common salt in a somewhat inclined position, and just so that the liquid entirely covers it, so that in the decomposition, the salts newly formed readily flow off to the bottom. Upon the sulphate of lead it is best to place another plate of zinc. In the course of nine or ten days, the lead salt is changed into a plate of lead sponge, which is extremely well adapted for receiving impressions.

This spongy lead is remarkably well suited for making models or matrices for galvanoplastic purposes. Under a good press it is converted into a flexible plate of dense metallic lead.

* *Jahrbuch für Prakt. Pharm.*, 18, p. 380.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

ON THE USE OF PYRO-GALLIC ACID IN PHOTOGRAPHY.

BY MR. FREDERICK SCOTT ARCHER.

IN my first short communication respecting the use of pyro-gallic acid in Photography (see THE CHEMIST, No. VIII, May, 1850, page 360), my intention was merely to introduce it as a powerful agent in developing the latent picture. I then said nothing respecting the best mode of proceeding so as to ensure success, merely giving certain proportions of the salts to be used, as a sort of introduction; but as it appears not at all unlikely that many will throw the thing aside as a failure from not taking certain precautions in the mode of operating which are necessary to obtain good results, I have thought it advisable to offer a few remarks on this part of the subject.

In the first place I must repeat what I said respecting the purity of the pyro-gallic acid, as this is a most important point to be attended to, otherwise a spontaneous change will be set up immediately the sensitive solution is applied to the iodised paper. The pure acid should be perfectly white, having a slight odor similar to that of balsam, and which arises, I should imagine, from a small quantity of empyreumatic oil, which may be in itself an impurity, although I am not aware if there is any mode of separating it from the acid; this odor is variable in different samples.

The formula I gave for the sensitive solution will answer very well if the solution of pyro-gallic acid is used within a day. In practice I have found it better to make only two or three drachms of the solution of pyro-gallic acid at one time to avoid this evil of decomposition: I will however suggest another mode of proceeding to prevent disappointment in this respect:—Prepare the solution of nitrate of silver, 20 grs. to 1 oz. of acetic acid, and instead of the solution of pyro-gallic acid, add a very small quantity of the acid in powder to the aceto-nitrate when wanted for use; thus, all risk of change will be avoided, the acid will dissolve directly in the aceto-nitrate solution by stirring it with a glass rod, and is ready for immediate application: in this way also a larger proportion of the pyro-gallic acid can be used if it should be thought desirable to obtain the picture with greater rapidity.

The most important point to consider, next to the purity of the chemical solutions, is, the form of Camera best adapted to operate with success in the open air, for as soon as the paper is made sensitive to light it must be used. This a difficulty which it is most desirable to overcome, and I

regret that in a paper like this, it will be almost impossible to give a clear description of what I should propose, more particularly as drawings cannot be given; however, by throwing out one or two hints respecting what is necessary, I cannot doubt that the best form of construction for the camera will readily suggest itself.

In the first place it is necessary that a slit (which may be, for a large camera, 1 inch wide and 3 inches long), should be cut in the top of it, midway between the back and front, into which a slip of yellow glass is inserted, and having a small hinged cover adapted to it, so that a small quantity of yellow light may be admitted into the camera when necessary. The upper right hand corner of the front of the camera should be cut off, and an elastic tube, about 2 inches deep, fixed on the opening, made just large enough to fit the socket of the right eye, with a cover to it, on hinges, shutting from the inside; a piece of glass must be cemented at the bottom of the tube to prevent the vapor of acetic acid injuring the eye.

There should be an opening on the right hand side of the camera, sufficiently large to admit the hand of the operator when he wishes to prepare the sensitive paper; this opening must have a tube, made of silk, about 12 inches long, fitted to it, and gradually diminishing towards the end, into which an elastic band must be sewn, to enable it to adhere close to the wrist to prevent the admission of light; it will be advisable to have a similar opening on the opposite side of the camera.

A water bath is placed inside the bottom of the camera, with a jointed cover, water tight, into which the paper is plunged immediately the negative picture is developed, in order to prevent any further change.

The back of the camera should open outwards, on hinges, and be furnished with a thin flat board, on to which a piece of plate glass is cemented, to which the iodised paper is made to adhere just previous to being made sensitive) by wetting the surface of the glass and damping the back of the iodised paper; no glass need be placed in front of the prepared paper, nor do I think it will be found necessary to have any ground glass, as the focus of the lens can be obtained on the paper at once by looking through the small opening in front of the camera. There are several other minor details, which I cannot now enter into, but which I imagine a little experience will soon suggest.

PREPARATION OF CHLORATE OF POTASSA IN THE LARGE WAY.

BY MR. F. C. CALVERT, OF MANCHESTER.

My attention having been attracted to the chlorates, and the numerous useful applications which might be made of them, if their high price did not stand in the way of their commercial employment, I have endeavored to discover a less expensive mode of preparing them. I have, I think, attained this object as regards chlorate of potassa.

The first chlorates which I obtained were those of lime and baryta. I produced them easily by passing a stream of chlorine into milk of lime and milk of carbonate of baryta, at a boiling temperature, and not at the ordinary temperature: for, in this case, we obtain, as is well known, only hypochlorites. The difficulty of separating the chlorates of baryta and lime from the chlorides of those metals, led me to renounce their preparation in the large way.

I then endeavored to discover a more simple means of preparing chlorate of potassa. I have attained this object by a quite new chemical action, namely, by making a mixture of 5½ equivalents of quick lime and 1 equivalent of caustic potassa, and passing into it when hot a current of chlorine gas. In this case, chloride of calcium and chlorate of potassa are produced; thus, by the employment of lime, we avoid the enormous loss of potassa, which, in the ordinary process, is converted into chloride, since, instead of producing 43 grains of chlorate of potassa from 100 grains of real potassa, I have obtained the proportion of 220 grains, which comes pretty near the theoretical number 260.

A fact which demonstrates, in a remarkable manner, how the chemical affinity of chlorine for oxygen is augmented by heat, is, that only a small quantity of chlorate is produced when chlorine is passed into a mixture of lime and caustic potassa maintained at the ordinary temperature.

Another point developed by my experiments is, the influence of the degree of concentration of the liquors. When, for example, a liquor of caustic potassa marking, at 84° F., 1·040, and containing, consequently, 34 grains of real potassa in 1000 grains of liquor, is mixed with 431 grains of lime, or 6 equivalents, only 130 grains of chlorate are produced.

Another mixture, made with 1000 grains of liquid containing 58·75 of real potassa in 1000 grains with 6 equivalents of lime, gave 168 grains of chlorate.

Finally, by taking a solution of caustic

potassa marking 1·110 density and containing 102·33 of real potassa in 1000 grains of fluid, and adding to it 6 equivalents of quick lime, and heating the whole gradually to 120° F., then passing a rapid current of chlorine (which raises the whole by the chemical action to 194° F.) to saturation, filtering, evaporating to dryness, then redissolving in boiling water, and allowing the whole to cool, I thus obtained 220 grains of pure chlorate of potassa, which I give as a conclusion, and as being capable of being applied to industry. For this process is worked on a large scale, and succeeds perfectly.

CHEMICAL ANALYSIS OF HUMUS, AND ON THE PART PERFORMED BY MANURES IN THE NOURISHMENT OF PLANTS.*

BY E. SOUBEIRAN.

THE Central Agricultural Society of the Lower Seine asks,—

"Are carbonic acid, the air, water, ammonia, and inorganic or mineral matters, the only substances which assist in the development of plants?

"Are the organic matters of the earth and of manures useful to plants only by the carbonic acid and the ammonia which result from their spontaneous and slow decomposition under ground?

"To give a complete chemical history of humus, or mould, and to ascertain if what is called ulmic acid performs an essential part in the act of nourishment of plants. To define correctly the part performed by *humus*, showing the parts performed by the mineral salts and by the organic principles which occur with them.

"Finally, to investigate experimentally whether, as maintained by Theodore de Saussure, contrary to the opinions of several modern chemists and physiologists, the soluble extract of the mould passes entire with the water into the absorbent vessels of plants."

The Agricultural Society calls the attention of observers to the action of humus in vegetation. It was a point of science which appeared to be most completely established, until it was controverted by chemists. It is necessary to elucidate this question without delay, in order to assign to humus the part which has hitherto been attributed to it in the theory of manures, or to reject the latter plan, conformably to the subordinate and accessory part which has been more recently assigned to it. The Society wished for a prompt solution; and, with this object, it fixed on the 1st of July as the day for sending in the memoir. The experiments of the candidates were limited to a time which does not embrace an entire period of vegetation. I hope, however, that the experiments detailed in this memoir will suffice for throwing some light on the great phenomenon of alimentation by humus. I shall afterwards complete them by other experiments, which could not be finished in time, but which can only confirm that which I have already seen.

In the first part of this memoir, I shall give the chemical history of humus, and I shall establish the part which it performs in the act of the nutrition of vegetables. In the second part, I shall study some manures, with respect to humus or matters capable of forming it; but I shall have an opportunity, at the same time, of correcting some errors, and of introducing some improvements into the methods of analysing manures, and, which is still more important, I shall reduce to their just value some axioms which have been laid down in science as absolute rules, and which are far from possessing so much importance.

FIRST PART.—*Of Humus.*

In the first part of this memoir, I shall study the properties of humus, examine what is its state in mould, and investigate its influence on vegetation. Is it a direct aliment of plants? Has it no other nutritive effect than the carbonic acid which accompanies its fermentation? Is it only a residue—a *caput mortuum* without effect?

My attention was attracted to this subject by the necessity I was under of analysing various manures. I have studied the works which have been published, and I must say that the contradictions which I have too often met with between authors, the evidently erroneous ideas which have been sometimes maintained by men of science, have compelled me to rely on my own experiments. I shall be happy if, in this vast and difficult, but most important, subject, I have been able to establish some truths, and to dispel some errors.

With regard to manures, the observations of practical agricultural writers are generally not very conclusive, and often contradictory, owing to not taking sufficient account of the various elements of the experiments to which they have devoted themselves. The chemical composition of manures and the constituent nature of the soil are not very perfectly known to them.

* This memoir obtained the prize of the Central Agricultural Society of Rouen, 1849.

It follows that their results, correct in the circumstances in which they operated, cannot be generalised, however, without the risk of contradiction at every step.

Chemists have rightly been reproached with too readily starting theoretical views based on a small number of facts, and with extolling them without measure. Those who have had confidence in this assurance have often gathered nothing but disappointment. This has brought the recommendations of men of science into well-founded discredit, which daily furnishes obstacles to the introduction of scientific applications into practical agriculture.

Three principal ideas have been broached concerning the theory of manures. The truth is found in these different and apparently contradictory opinions. Each of them is a progress; provided that an absolute value be not given to it, and to the exclusion of the other two.

Agricultural writers state that lands richest in humus are the best; that the object of manure is to furnish humus to the soil; that the latter is, for plants, the aliment *par excellence*, and, as a consequence, that a manure without humus is of little or no value. According to Liebig, on the contrary, humus is only an accessory which should be rejected on the last plan. Furnish to the plant the saline part necessary to its existence, and you will find it form in proportion the sanguifiable principles which constitute the value of our aliments. In Liebig's opinion, humus is never the direct aliment of the plant; it aids it in its nutrition only by the carbonic acid which results from its successive transformations. Finally, according to the French School, at the head of which their labors have placed MM. Boussingault and Payen, the proportion of nitrogen is the measure of the value of manures. These two savans have gone so far as to base on this principle a table of equivalents.

To every mind free from systematic ideas the problem thus laid down appears solved. Agricultural writers are right in appreciating the presence of humus in manures; Liebig has done well to demonstrate the influence of the salts as stimulants of vegetation, and an essential constituent elements of some alimentary principles; MM. Boussingault and Payen are warranted in saying that the value of a manure rises with its richness in nitrogenous matter, but he is still more right who asserts that the best manure is that which contains the three essential elements, namely, humus, the salts, and nitrogenous matter.

The type of humus is found in mould: it arises from the slow decomposition of ligneous matter. In contact with the air and moisture a portion of the hydrogen of the ligneous matter is burned; and, the equilibrium once destroyed, carbonic acid is formed at the expence of the other elements. The result of this action is a progressive increase in the proportion of carbon, which stops, however, because the affinity of the hydrogen for the carbon prevails in proportion as the wood becomes hydrogenated, and finally comes to an equilibrium, owing to the oxidising agency of the air.

Humus, carbonaceous mould, and rotten matter are the three terms which have been recognised in this gradual decomposition of wood. Humus is characterised by its solubility in the alkalis: carbonaceous mould is not soluble in them, but, by exposure to the air, it gives carbonic acid and acquires solubility. As regards rotten matter (*pourri*) it would be the last term of the decomposition, according to Liebig. As wood, it would contain oxygen and hydrogen in the same proportion as water, but carbon would be more abundant in it. It would be, it is said, only in the presence of the alkalis, that it would be capable of acting on the oxygen of the air, giving a soluble product analogous to humus.

The series of these compounds has not been properly established The first term is certainly the matter which has been called *carbonaceous mould*, an improper denomination, which I have retained here only on account of the inutility of creating a new name for a body of passage which varies each moment in its composition. Carbonaceous mould is formed by the action of air on wood, when this action has not gone far enough to produce humus. The effect continuing, humus appears in its turn; and this is the reason why mould, first exhausted, and then abandened to the air, again gives soluble humus after a certain time.

Humus is, we have said, the portion of mould soluble soluble in alkaline solutions. As regards *pourri*, its existence appears to me to be perfectly hypothetical. No experiment has demonstrated in mould the existence of this body containing more carbon than humus, and which would possess the singular property of commencing the series of decompositions, by furnishing, in contact with alkalies and the air, a body less rich in carbon than itself.*

* I do not mean to speak here of the rotten matter which is formed under water when oxygen is wanting. I have met with it in the mould formed at the foot of trees. It occurs in dung when the air has not penetrated into the heap.

I made my first experiments on mould which was sent to me by M. Neumann, head gardener at the Jardin des Plantes. It was one of those worn-out moulds which kitchen-gardeners do not like, as they are wanting in heat, but in which a vigorous vegetation takes place.

Alcohol removed from it only some unimportant fatty or resinoïd matters. It gave a yellow color to water, and, for a very long time, it continued thus to furnish colored solutions. These solutions contained a small quantity of nitrates, sulphates, chlorides, and traces of phosphates, salts which might have caused the solution of the organic matter.

Dilute or concentrated ammonia, put in contact with mould, out of contact with the air, gives only a slightly colored solution, in which the acids form a slight precipitate; but, in contact with the air, and especially with heat, a brown liquid is formed, which the acids precipitate in abundance.

This experiment indicates the presence of a little free humus in the mould. It demonstrates the abundant formation of this body under the influence of the air and alkalis.

A larger portion of humus is already formed in the earth, and exists in it in combination with lime. This is proved by treating the mould with a dilute acid, washing it with care, and putting it in contact with liquor ammoniæ. This time we directly obtain, out of the influence of the air, a very deep colored solution, which the acids precipitate copiously. But here is a capital experiment on this subject. I prepared humate of lime; by precipitating with chloride of calcium, an ammoniacal solution of humus. The humate of lime, after having been washed, was treated with caustic ammonia. With or without the aid of heat, the liquor with difficulty acquired a yellow color, which proves that ammonia, which was colored immediately in contact with the mould, forms it by dissolving free humus, and not by removing humus from the humate of lime.

In this experiment, by replacing the ammonia by carbonate of ammonia, we obtain, either with pure humate of lime or with mould, deep colored liquors; this is an excellent experiment, which teaches us the part performed by carbonate of ammonia in manures, which is that of rendering soluble the humus which has been fixed by the calcareous bases.

The mould which was exhausted by water, hydrochloric acid, and ammonia, recovers, by prolonged exposure to the air, the property of again giving a colored liquor with ammonia. Its conversion is much more quickly effected in the presence of an alkali. By operating under a bell-glass over mercury, I have directly proved the absorption of oxygen from the air, and the formation of humus soluble in ammonia. In another experiment, the exhausted mould acquired in a few minutes, in contact with the air and ammonia, the property of coloring water brown. By washing it and repeating the experiment, I was enabled, in many cases, to reproduce the same result. The formation of humus under the influence of the alkalis is therefore indisputable; the alkaline carbonates, and especially the caustic alkalies, possess this property in a higher degree than ammonia.

Doubt has been cast on the identity of the humus extracted by the alkalis with the humus as it exists in the mould However, if we take account of the small quantities of acid that the precipitated humus retains, there is no reason for establishing a distinction between these bodies. Moreover, it is never directly, but after having been rendered soluble by the alkalis, that humus penetrates into the plants; so that the humus which serves it as food has undergone the same influence as that which has been directly prepared by ammonia and mould.

Before going farther, I must say a few words on what is called the *extract of mould*. Extract of mould is, with some, the portion of humus which is dissolved when mould is treated with cold water. It is really only humus whose solution has been facilitated by the calcareous or alkaline salts. The *extract of mould* has also been applied to the portion which is dissolved in alcohol, when, after having precipitated an alkaline solution of humus, the precipitate is redissolved by that spiritous vehicle. This time it is not the humus which is dissolved, but a combination of the humus with the acid used for precipitating it. I arrived at this conclusion by observing that humus, which had been precipitated by sulphuric acid, dissolved abundantly in alcohol; and, by recollecting the well-known fact, that a solution of humus in an alkali cannot be precipitated by acetic acid, I precipitated humus by hydrochloric acid; I washed the precipitate for a long time with distilled water; the liquor was scarcely tinged with nitrate of silver; perhaps even this little was due to a little humus dissolved. At this moment, I redissolved the precipitate in alcohol, first without heat, and then with. I then sought for the presence of chlorine in the alcoholic liquor and in the insoluble portion. I operated by the desiccation and calcination of each of them with carbonate of potassa;

the liquid gave a residue rich in chloride; the humus, exhausted by alcohol, contained none.

We cannot hope to determine the composition of humus with absolute accuracy. When, after having dissolved it by ammonia, it is precipitated by means of an acid, it may remain mixed with certain matters which accompany it in the mould, and which, like it, are dissolved in the alkalis and precipitated by the acids. After having washed the mould with dilute hydrochloric acid and water, I treated it with ammonia, and I precipitated the humus with hydrochloric acid; then, after having purified it by washings in distilled water, I exhausted it successively by alcohol and ether.

Polydore Boullay found in artificial ulmine— 56·92 carbon
43·08 water.

M. Peligot admits that ulmine contains actually 72·3 per cent. of carbon. He thinks that Polydore Boullay burned the matter incompletely; this supposes that skilful chemist to have made an error of 15 per cent., which is inadmissible. I will very soon explain how these two chemists could arrive at such different results.

The analysis of the ulmine extracted from mould does not give any fixed number; nitrogen is always found in it, and the proportion of the other elements in it is always variable. Being surprised at the discordances which I met with in analyses whose accuracy I could not suspect, I have finally concluded that the composition of the humus extracted from mould varies, and that carbon predominates in it so much the more as the air has acted for a longer time during its formation. I have found from 52 to 56 per cent. of carbon; never more than 57. It seems that in these circumstances of formation in which the alkali is dilute and the temperature always moderate, it is not possible to arrive at the extreme limit which M. Peligot has assigned to artificial ulmine.

I have ascertained, however, that the proportion of carbon really increases under the prolonged influence of air and an alkali. I dissolved, in a weak solution of carbonate of soda, humus which contained 53 per cent. of carbon; I kept it boiling for 40 hours, and then precipitated the humus, in order to analyse it again; this time it contained 57 per cent. of carbon. Humus soluble in the alkalis is, therefore, variable in its composition. A period arrives at which wood is changed into soluble humus, but after this time, the proportion of carbon may yet increase in it, without the body formed losing the new properties which it has acquired, and which render it fit for the nutrition of the vegetable. It has no absolutely definite proportions: like all organic bodies which are transformed by slow actions, there is a series of insensible passages in which the mind refuses to establish distinct species.

I consider it useless to detail here the numbers which I have found in different varieties of humus. One of them, prepared with a weak solution of caustic soda, yielded 56·4 of carbon; humus always contains nitrogen: its proportion varies between 2 and 2·5 per cent. I think it necessary however to detail the results furnished to me by humus, extracted from the powder of old wood.

It is known that in forests, old trees may be found whose trunk slowly decomposes internally, and is ultimately reduced to a powder of a more or less deep brown. When this decomposition is very far advanced, a slight blow suffices to bring down an abundance of this product of decomposition. In an old oak of the forest of Fontainebleau, which has a large hole at the foot, on a level with the ground, I collected the decomposed wood which I used in my experiment. It was moist, and its color was that of Spanish snuff; its properties were those of the purest mould.

It was insipid and inodorous; it did not color water; it gave with ammonia a very deep solution; precipitated by an acid and redissolved in ammonia, it again formed a colored solution. Finally, this old wood, thus exhausted, readily gave a new colored liquor on contact with the air and alkalis. The powder of old wood consisted, therefore, of a mixture of pure humus, of a little humate of lime, and of matter not yet converted into humus, but susceptible of that conversion in contact with air and an alkali.

I extracted the humus from old wood by first washing with water, and then treating it by ammonia. This solution was precipitated by hydrochloric acid, and the humus was purified by several washings in water, boiling alcohol and ether. I then analysed it. It left 7·16 per cent. of ashes. By Warrentrap and Wills' method it yielded 2·5 per cent. of nitrogen. Combustion with oxide of copper and chlorate of potassa, (the ashes being deducted), gave:

5·53 grammes of humus

Carbonic acid.	1·15 gr.	= Carbon	313	55·3
Water.....	0 248	Hydrogen	27	4·8
		Nitrogen		2·5
		Oxygen		37·4
				100

1 gramme of humus			
Carbonic acid..	2·007 gr. =	Carbon	55·0
Water	0·432	Hydrogen	4·8
		Nitrogen	2·5
		Oxygen	37·7
			100·0

These analyses, the nitrogen being abstracted, approximate singularly to the formula $C^{34}H^{18}O^{18}$.

It is well to remark that in this humus formed by exposure to the air and moisture for a great number of years, the carbon did not exceed 55 per cent. It appears that this is the extreme limit that the decomposition of wood can attain without having recourse to heat and concentrated alkalis. This limit is very far from the term (72 percent.) which M. Peligot reached in artificial ulmine.

As to the nitrogen, it is always one of the constituent elements of humus, but it would be impossible to say what proportion belongs to it and what proportion may form part of the nitrogenous products mixed with it. It must be remarked that in the powder of old oak wood, the quantity of nitrogen is greater than in the living wood from which it was formed. This fact renders it probable that a portion of the nitrogen of the air has been fixed during the decomposition of the wood. This was the opinion of Theodore de Saussure. It might be attributed to the remains of insects being left there; but for a long time they can have found no refuge in this powder without consistence which the least shake caused to fall to the foot of the tree.

Liebig has admitted that, by a more advanced decomposition, humus is converted into rotten matter, which would be characterised by a larger proportion of carbon, and because it would be susceptible of acting on the air only in presence of the alkalis. I do not know any experiment which can demonstrate to us the existence of this body; its formation is even rendered utterly improbable by the facts I have detailed. We see, indeed, that pure humus, that is to say dissolved by an alkali and precipitated, exerts on the air only an insignificant action; in six months, kept over mercury, it scarcely perceptibly modified the volume of air. When ammonia is added, the effect is a little more marked, but the action is still one of the slowest, and it would require many years before the humus could attain the proportion of 72 per cent. of carbon, in which it is still soluble in ammonia. This limit is not even approched in the powder of the old wood, which has, perhaps, been subjected to the oxidising action of the air for 15 or 20 years.

ACTION OF HUMUS ON VEGETATION.

Agricultural writers believe that humus serves directly for the nourishment of plants. According to Liebig, its utility consists in this, that being in a continual state of decomposition, humus forms carbonic acid which is proportionally absorbed by the roots. The celebrated chemist of Giessen appears to me to have set too low an estimate on the service of humus as an alimentary matter of plants. The reasons on which he based his opinion have not all the value which he has ascribed to them. Combating the idea that mould may be absorbed in the state of humate of lime, Liebig asserts, from the quantity of bases found in the ashes of vegetables and from the composition of the humates, that the quantity of carbon which might be so introduced would form only a very minute portion of the total carbon of the plant. The sparing solubility of humate of lime also furnished him with an argument of the same tendency; but both lose their weight when I show that it is principally in the state of humate of ammonia that humus penetrates into the vegetable. The carbonate of ammonia which is formed by the putrefaction of manures acts by dissolving the humus formed, and expediting its formation under the combined influence of air, or to bring, in the state of solution, the humus contained in the soil, to the state of humate of lime. The quantity of humus absorbed by the plant cannot then be estimated by the solubility of lime in water, or by the constitution of the ashes of the plants. The ammonia which has served as a solvent is elaborated and converted in the tissue of the plant, and aids directly in the formation of nitrogenous products.

Liebig also affirms, that woods and prairies ameliorate the quality of the soil, although no manure is ever introduced and although crops of hay and wood are annually removed. Plants, then restore to the soil more than they receive from it, and the carbon removed in the form of crop is derived from the atmosphere. This reasoning cannot be admitted against the utility of humus, for if the humus absorbed has the effect of giving a nourishment which increases the vitality, and which augments the number and size of the organs of absorption, it will happen that the plant will derive more largely from the atmosphere. The humus, without having furnished all the carbon, will, however, be the effectual cause of this superabundant production of wood and of the other elements of the vegetable. Besides, is not the question decided by the commonly known fact

that in earth without humus, vegetation is always meagre and unproductive.

On Liebig's hypothesis, according to which the part performed by mould is limited to furnishing to the roots the carbonic acid resulting from its transformation, the humus itself ceasing to be a cause of it. It is not indeed the humus which is transformed, but the ligneous matter, the carbonaceous earth. Once changed into humus, they cease to act, for humus being soluble in the alkalies, is preserved with extreme tenacity in contact with the air and moisture; if the alkalis intervene, its decomposition is scarcely accelerated. Why should Nature produce a body which is to remain inactive and inert? Why suppose, moreover, that this body, rendered soluble by the alkalis, and particularly by the carbonate of ammonia, will not be absorbed by the roots, so as to serve for the nutrition of the vegetable? It is absorbed indeed, and the following are the experiments I have made on the subject:

I carefully removed from the earth a strong root of Lapsana communis. I washed the roots with water, and I kept them steeped in a very dilute solution of humate of ammonia, deprived of all excess of alkali by long exposure to the air. The liquor and roots were preserved from the light. During 8 days that the experiment lasted, the plant throve. Every day I put the roots into a new solution, and I restored the liquor which had been used the day before to its original bulk, by replacing with distilled water the portion which the plant had absorbed. The weakened tint of the liquor proved sufficiently that a portion of the humate of ammonia had been absorbed.

In 1848, in earth deprived by fire of all organic matter, but to which I had added a little bone phosphate and sulphate of lime, I sowed oats and beans. When the plants sprung up, I watered them daily with a weak solution of very neutral humate of ammonia. The vegetation was good and I obtained from both a good crop of flowers and fruit. It cannot be admitted that, in these experiments, the humate of ammonia was converted into carbonic acid, which would have been absorbed by the plant; it was the water held in solution which penetrated directly into the vegetable, and which realised for it all the conditions of a profitable nourishment. The vigor preserved by the root of the Lapsana, submitted to experiment, the beautiful vegetation of the beans and oats, under the same regimen, the flowers and seeds which they both furnished, sufficiently proved the favorable conditions in which their development is effected.

I am now warranted in concluding that humus, under the form of humate of ammonia, is absorbed by the plants, and that it directly assists in their development.

It remains to be discovered what this humus becomes, when once it has penetrated into the radical spongioles—does it immediately undergo some transformation, or is it carried further by the sap vessels? I shall say nothing on this point at present.

It must be remembered that the root of humus is not limited to furnishing food to the plant. It has an hygrometric action, absorbing moisture from the atmosphere, and maintaining in the earth a salutary coolness; it condenses and retains the ammonia which is supplied to it by the atmosphere; it acts as an antiseptic moderating the decomposition of nitrogenous matters, allowing it to take place only gradually, so as to furnish to the plant an aliment always scanty but continuous; it fixes the ammonia which results from this decomposition. If it had not of itself a direct nutritive power, these valuable qualities would be sufficient for giving an indisputable superiority to the manures which contain humus associated with other nutritive principles. An admirable provision of Nature, which, from the obscure work of putrefaction, which annihilates the remains of dead vegetables, produces the elements which will furnish an abundant and necessary nourishment to the generations which succeed them.

From the experiments detailed in this first part of my memoir, I conclude:—

That, in the formation of mould, the first term of the decomposition is the carbonaceous mould, which differs from wood in containing a larger proportion of carbon, and from humus by a smaller proportion of that element.

That the second term is humus characterised by its solubility in ammonia.

That, in ordinary mould, part of the humus is free, and a larger portion is combined with lime. The contrary is the case in the mould of old oaks.

Humus always contains nitrogen. The proportion of carbon varies between 53 and 56 per cent., and does not exceed 57.

Humus serves directly for the nourishment of plants. Its absorption takes place particularly under the form of humate of ammonia.

In ordinary earths, the tannate of ammonia results principally from the reaction of ammonia on humate of lime.

To be continued.

ON THE PURIFICATION OF COAL GAS.

BY MR. LAMING.

A PAPER was read before the Society of Arts, on the 24th of April, 1850, on the above subject, giving some details of Mr. Laming's patent process, whereby he has succeeded in effecting the complete purification of coal-gas, by the chemical action of its own impurities on the materials which do not require to be periodically renewed. The peculiar feature of the invention is, to cause the sulphur in the gas to become spontaneously converted into sulphuric acid, and then to combine with the next greatest impurity, viz., the ammonia, and form sulphate of ammonia, which is a solid and inodorous salt of considerable value. The carbonic acid of the gas, which is mainly instrumental in bringing about these chemical changes, escapes after having done its office, and is got rid of without expense. The author of the paper commenced by observing, that it was surprising that the perfect purification of gas, so important both in a sanitary and commercial point of view, should have excited so little interest in persons capable of investigating the subject; and that now, after nearly half a century, the problem remains as far from a satisfactory solution as ever. That the primitive and palpably imperfect purification by lime should be still universally prevalent, may appear blame-worthy on the part of the officers to whom public companies have entrusted the internal arrangements of their works; but when the extent and diversity of the duties of a gas engineer and the purely chemical character of gas making are taken into consideration, it rather excites surprise that the directors have not seen it prudent to aid their engineers by appointing competent and intelligent chemists to assist them. The author then alluded to inventions calculated to aid the lime in its purifying powers, and remarked that none of them pretended to be able to supersede the use of lime altogether. In using lime, the loss of material is so great, that not more than 33 per cent. of the quantity employed is really effective; it removes very little of the ammonia; and its odor, when taken from the purifying vessels, is universally known to be detestable. The process of Mr. Laming has been tried in Paris, and successfully carried out in the Chartered Company's Works at Westminster; first, on a production of about 7000 cubic feet of gas per hour, and subsequently in purifiers ten feet square. The purifying material virtually consists of a mixture of the two oxides of iron and calcium, which the author sometimes makes by decomposing a saturated solution of muriate of iron by lime or chalk, and then mixing in breeze or sawdust to give to the mass the necessary permeability. This material withdraws from the gas 22 parts of carbonic acid for every 17 parts of ammonia which it removes, besides the sulphuretted hydrogen. The perfection of its action is such, that the gas which has passed through it does not afford the slightest trace, either of ammonia or sulphuretted hydrogen, to the most delicate tests.

While the mixture is being made, the iron becomes peroxidised by the atmosphere: a result which is greatly facilitated by its spontaneously elevated temperature, as well as by the porosity of the mass. The affinities called into play on passing impure coal gas through this very pervious material placed instead of lime in the ordinary lime purifiers, are as follows:—The impurities are dissolved in the moisture of the absorbent matter, which is forcibly retained by the hygrometric nature of the muriate of lime also dissolved in it. The sulphuretted hydrogen then combines with the peroxide to form water and sesquisulphuret of iron. The ammonia, at the same time, is attacked by the carbonic acid, giving up in exchange the sulphuretted hydrogen with which it is in part combined; while, in proportion as the ammonia and carbonic acid unite to form carbonate of ammonia, the latter salt reacts on the muriate of lime, with production of muriate of ammonia and carbonate of lime. When none of the oxide of iron and muriate of lime remains unchanged, the vessel which contains the materials is thrown for a time out of connexion, and the materials are exposed to atmospheric air, by which their purifying powers become regenerated.

The affinities in this regeneration are as interesting as those concerned in the gas purification. The oxygen of the air changes the sesquisulphuret of iron into a sulphate of iron; and this salt and the carbonate of lime reciprocally decompose each other, forming sulphate of lime and carbonate of oxide of iron; but as artificial carbonate of iron is not persistent in the presence of atmospheric oxygen, it becomes quickly changed into hydrated peroxide of iron, the carbonic acid escaping into the air.

These changes, brought about by the action of the atmosphere, reproduce the purifying material in its pristine energy, with this difference: that as the process began with the muriate of lime combined with the oxide of iron, the process is continued by that oxide mixed with the precipitated sulphate of lime, which acts on the

carbonate of ammonia in precisely the same way as the muriate of the same base

The regeneration of the used materials is completed in an hour or two, and the author has already effected it as many as fifteen times; there seems, in fact, to be no end of it; but undoubtedly a time must arrive when the accumulated salt of ammonia will need to be washed out; and, when this has been done, the material will be again in its pristine force.

The advantages of this new process are, that the gas is completely purified, even from its sulphuret of carbon, the most intractable of all its impurities (and that with an increase in illuminating power, which has been estimated as at least 8 per cent.); the materials are inexpensive and susceptible of repeated use an infinite number of times, with little labor; they give no unpleasant odor when done with; convert the impurities of the gas into marketable products of value; and the wear, tear and cost of apparatus, generally an important item, is reduced to a minimum.

Liebig conceives that peroxide of iron is the purifying agent of the human blood, absorbing oxygen in the lungs, and passing as arterial blood to the various parts of the system, where it combines with organic matter and evolves heat, with the production of carbonate of oxide of iron; in which state it returns as venous blood to the lungs, and is then decomposed, with evolution of carbonic acid and reformation of peroxide of iron. and so on as before. If this be correct, the resemblance of the two processes is curious and interesting.

[Mr. Laming's patent is in use at the works of the Chartered and Imperial Gas Companies, and, we understand, succeeds perfectly. The amount of coal annually consumed for the manufacture of gas in London is about 360,000 tons, of which 170,000 are burned by the above two companies.—EDITORS.]

ABSTRACTS OF SPECIFICATIONS OF CHEMICAL PATENTS RECENTLY ENROLLED.*

Improvements in the manufacture of sugar. CHARLES COWPER. Sealed Nov. 14, 1849.

MR. COWPER states that his invention relates to the removal of impurities, and obtaining sugar from cane and beetroot juices, sugar solutions, and saccharine liquids; and that the object of using lime in the defecation of these liquids, according to the present system, is to saturate acids contained therein, and, consequently, to facilitate the formation of scum, for which purpose the lime and juice are boiled together, whence the following disadvantages result:—

1. A great alteration of an nitrogenous matter, the decomposition of which forms the greater portion of the ammonia disengaged, while the rest, combining with the lime, acquires a brown color, and is dissolved in the juice.

2. The combination of a portion of lime with sugar, which becomes insoluble when exposed to a temperature of 212° Fahr., and is often removed with the scum, occasioning a loss of sugar.

3. The alteration of an albuminous matter which, combining with the lime, forms a stringy and viscid substance, which prevents the crystillization of the sugar.

4. An alteration of the sugar itself, which, under the influence of the matters contained in the juice, and of the heat to which it is subjected during the defacating and subsequent operations becomes uncrystallizable, and acquires a brown color difficult to remove.

5. An alteration of the coloring matter, which, combining with the lime, passes from green to brown, gradually deepening in color until it acquires the characteristic tint of molasses or raw sugar.

It has frequently been proposed to obviate these objections to the use of lime by filtering the syrup through animal charcoal, using less lime, or acting on the precipitate with sulphuric acid, sulphate of alumina, carbonic acid, stearic acid, &c. But these operations have failed from the fact that the formations had previously taken place, and the action of any of the re-agents on the precipitate, by reducing it to the fluid state, freed the impurities contained therein, which were afterwards dissolved in the juice, imparting to it viscedness and color.

The patentee proposes to avail himself of the peculiar property of lime, at certain temperatures, to coagulate the organized tissues and organic and mineral impurities which the juices contain, and to use it in larger quantities; but to escape the injurious results alluded to by not raising the liquids to the boiling point. For this purpose, he takes the juice, as it is obtained in the first instance from the cane or root, and heats it to from 122° to 167° Fahr.; lime, previously slaked and sifted, is then mixed with it, and the temperature raised from 186° to 194° Fahr., after which the impurities may either be removed by skimming,

*Collected from *The Mechanics' Magazine.*

or will subside to the bottom. The clear liquid is decanted off. The sugar is obtained from the saccharate, which it forms by combining with the lime, by treating it with some of the known re-agents—by preference, carbonic acid—whereby the sugar is liberated, and carbonate of lime formed. The carbonic acid is subsequently expelled by boiling the liquid. The liquid is filtered and concentrated, and placed in vessels to crystallize. The proportion of lime will depend upon the temperature of the weather, the quality of the juice and nature of the soil, and can only be determined by practice. Thus, for beetroot juice from 15 to 50lbs. of lime is used in 100 gallons of juice.

The drainings of the loaves are defacated by mixing with them a proportionate quantity of lime and silica or alumina, which is found in plastic clays, to combine with the salts of potassa or soda;—the proportions being 20 or 30lbs. of lime, 2 to 4 lbs. of silica or alumina for every 100 gallons of juice. Care must be taken, as in the preceding case, never to raise the temperature of the liquid to the boiling point. The liquid is subseqently concentrated, and granulated sugar formed, which may be mixed with the drainings in the first instance, and formed into leaves.

It is proposed to generate carbonic acid by driving a current of air, by means of a blowing cylinder, into a vessel filled with ignited coke and charcoal, and closed on all sides except where the air enters at bottom and escapes at top. The carbonic acid is led through a pipe, enveloped in a casing filled with cold water, and conducted to beneath the surface of a quantity of water, through which it escapes, and, after being thus washed and purified, is led into a coiled pipe placed in the bottom of a vessel, which contains the saccharine liquid. The carbonic acid escapes into the liquid through perforations in the tube, the aggregate area of which is equal to the area of the tube.

Improvements in manufacturing leather. (A communication.) ALFRED VINCENT NEWTON. Sealed November 7, 1849.

THE patentee states that the object of this invention is to effect the tanning of leather more speedily than has hitherto been accomplished, and at the same time to improve its quality. With this object, he takes for every 100 calves' skins, unhaired and freed from lime,

20 lbs. potash alum, and 10 lbs. of chloride of sodium.

100 lbs. of mimosa catechu.

4 lbs. of sulphate of alumina, either alone or mixed with 2 lbs. of chloride of sodium.

The three mixtures are dissolved in water and kept apart in different vessels.

Of the first solution one-fifth, of the second one-tenth, and of the third one-fourth are placed in a vat, and the skins are put in and pushed round the vat by men armed with poles, or by a machine. After a short time, the skins are taken out, and one-fifth of the first solution, one-tenth of the second, and one-fourth of the third added to that in the vat. The skins are again treated as before. After a longer period than in the first case, they are taken out, and one-fifth of the first solution and one-tenth of the second poured into the vat. The skins are again immersed, and allowed to remain in some time, with occasional agitation. They are again removed, and the remainders of the first and third solutions, and one-fifth of the second, are added, and the skins immersed; after some days, the remaining two-fifths of the second mixture are added. In four or five weeks the skins are completely tanned.

As a modification of the preceding process, it is suggested to lay the skins in a pit, with about 3 lbs. of bark between each, and mixed with water. The pit is to be provided with a hand pump, for pumping the tanning-liquid from the bottom on to the top skin.

The patentee gives the following proportions:—

For 100 goat skins, 10 to 12lbs. of alum, 6 lbs. of chloride of sodium, and from 50 to 60 lbs. of mimoso catechu.

For 100 cow-hides—200 to 300 lbs. of sulphate of alumina, 100 lbs. of chloride of sodium, and 500 lbs. of mimosa catechu.

For 190 ox-hides—14 to 16 lbs. of sulphate of alumina, 8 lbs. of chloride of sodium, 12 to 14 lbs. of mimosa catechu. From 50 to 60 lbs. of the latter are subsequently added.

The patentee claims the mode of tanning leather by employing substances to act directly on the albuminous matter of the skins, such as sulphate of alumina, potash alum, chloride of sodium, sulphate of magnesia, chloride of zinc, &c., and substances containing tannin, to act upon the gelatine of the skin, such as the mimosa, catechu, bark and leaves of oak, the bark of poplar, chesnut, spurge laurel, sumach, &c., according to the proportions and processes described, taking for a standard, mimosa catechu of good quality, which contains 50 per cent. of tannin.

Improvements in the manufacture of sugar. CHARLES COWPER. Sealed Nov. 20, 1849.

THIS invention relates to the treatment of cane juice, beetroot juice, or other saccharine liquids, with caustic baryta, and to the separation of it from the carbonate of baryta, which is formed by this operation.

The saccharine liquid is heated to 167° Fahr., and caustic baryta, previously slaked and mixed with sufficient water to reduce it to the consistence of cream, is added in the proportion of 60 lbs. to 100 gallons of juice. This mixture is then raised to the boiling point, when the baryta and sugar precipitate in the form of saccharate of baryta, and the superabundant liquor is decanted. The sugar will thus be separated from its impurities, which will be held in suspension by the water. The precipitate is to be washed and pressed to expel the moisture, when it will assume the appearance of cakes; or it may remain in the state of magma or thin paste The cakes are broken into small pieces, and mixed with one and a quarter their weight of water; or in case of the precipitate being a magma it is mixed with a quantity of water sufficient to produce a similar result. Carbonic acid is now passed through the mixture, whereby the sugar will be liberated and retained in solution by the water, while the baryta will be precipitated in the form of carbonate of baryta. The saccharine solution is drawn off and concentrated, by boiling, to 1·27 specific gravity, when the syrup is filtered, to obtain the baryta which will be precipitated by heat, and concentrated to the crystallizing point. It is lastly poured into vessels and allowed to crystallize. The solutions which have been drawn off may be turned to account by concentrating them to 1·27 specific gravity (filtering as before) and converting them to alcohol by fermentation. The locality of the works may sometimes render it desirable to use some other base than baryta, such as strontia or oxide of lead, capable of forming an insoluble saccharate; and in some cases it may be advisable to form first a soluble saccharate to be afterwards converted, by double decomposition, into an insoluble saccharate—the soluble saccharate being mixed with the solution of a salt capable of forming an insoluble saccharate and a soluble salt. Instead of carbonic acid, sulphuric, phosphoric, or boracic acid may be used, provided it will precipitate with the baryta and liberate the sugar. The process described may be applied to the treatment of raw sugar by dissolving it in water, and adding caustic baryta; proceeding with the rest of the operation as before. Instead of caustic baryta, its equivalent of hydrate of baryta may be used.

To recover the caustic baryta from the state of carbonate, the patentee proposes to employ either of the following two processes:—

1. The carbonate of baryta is treated with sulphuric acid in a close vessel, to form sulphate of baryta, and the carbonic acid disengaged, is applied to the treatment of the saccharate of baryta. The sulphate of baryta is converted into sulphuret of barium, by heating with charcoal, or other carbonaceous matter, in a furnace, or, (when it is desired to collect the carbonic acid), in a retort; the sulphuret of barium is separated from the carbonaceous matter by washing, and will form a solution which is to be boiled with the oxide of copper. The resulting products are sulphuret of copper and hydrate of baryta. The sulphuret of copper is reconverted into oxide of copper by roasting, in order that it may be rendered again available.

2. The object of the second process is to separate the caustic or hydrate of baryta from carbonate of baryta by double decomposition. For this purpose any of the sulphates may be employed—some in a dry and some in a wet state—but the patentee prefers to use sulphate of soda or potassa, or carbonate of soda, or potassa. The mode of operating with sulphate of soda is the same as for sulphate of potassa, with the exception that 218 parts of the latter are to be employed instead of 178 of the former. If it were not desired to effect a complete decomposition, it would simply be necessary to mix one equivalent of sulphate of soda with one equivalent of carbonate of baryta, in which case there would be formed, on the one hand, a mixture of sulphate of baryta, formed by decomposition, with undissolved carbonate of baryta, and on the other, a solution of carbonate of soda, formed by decomposition, with an undissolved sulphate of soda. It is proposed, therefore, to employ the dissolving salt, in excess of the salt to be dissolved. Also, if it be desired to separate the last portion of sulphuric acid it is necessary to use a substance (by preference lime) which will combine with the carbonic acid as it is set free by the sulphuric acid.

FIRST OPERATION.—178 parts by weight of sulphate of soda are dissolved in three times that weight of water, mixed with 123 parts of carbonate of baryta, and boiled for two hours, whence will result a solution of carbonate and sulphate of soda, and a precipitate of sulphate of baryta, which is to be washed and set aside to be afterwards converted into sulphuret of barium. The washings are also to be preserved and employed in the subsequent operations.

SECOND OPERATION.—The solution of bonate and sulphate of soda, resulting from the first operation, is mixed with 246 parts of carbonate of baryta and 71 parts of lime. The mixture is boiled for about two hours and then allowed to precipitate, when there will be formed a carbonate and sulphate of baryta and a carbonate of lime. The solution is to be decanted off, and may be converted into caustic soda, or carbonate of soda.

THIRD OPERATION.—This precipitate is mixed with the same quantity of sulphate of soda as was used in the first operation, dissolved in the washings before referred to, and the mixture boiled for two hours, when the sulphate of baryta and carbonate of lime will be precipitated; the supernatant solution (sulphate and carbonate of soda) is drawn off, and employed for the second operation. The precipitate (sulphate of baryta, and carbonate of lime), is mixed with carbonaceous matters, and heated to redness in a retort, or closed vessel, to collect the carbonic acid gas which will be disengaged from the lime, and by the reaction of the carbon on the sulphate of baryta, and which, after being washed, is to be employed to decompose the saccharate of baryta. The resulting products will be sulphuret of barium, lime, and carbon, which are to be washed; when the sulphuret of barium will be separated from the lime and carbon, and be held in solution, which is to be converted into hydrate of baryta, in the manner before described.

The patentee claims the recovery of baryta from carbonate of baryta, formed in the manufacture of sugar, by decomposing it with sulphuric acid.

Improved modes or methods of applying galvanism and magnetism to curative and sanatory purposes. C. L. A. MEINIG. Sealed Nov. 17, 1849.

CLAIMS.—1. The employment for curative and sanatory purposes of portable electro-magnets, constructed and operated with in a peculiar manner, which the patentee fully exemplifies and describes.

2. Employing for the said purposes the influence of portable magnets, protected from oxidation by a thin coating of gold or gutta percha, or other like incorrodible and not easily permeable substance.

3. The combination of portable magnets, or electro-magnets, and portable galvanic apparatus, for the purposes afore-said.

4. The producing long-continued galvanic or magnetic effects on animal bodies by means of portable galvanic apparatus attached to such bodies (but independent thereof for their moist element).

5. The producing magnetic effects on animal bodies, or parts thereof, by transmitting electric currents along or around the surfaces thereof by portable conducting apparatus.

6. The application of portable magnetic apparatus to animal bodies in such a manner that one, or principally one, polarity only of magnetism shall act on each of two different parts of the said bodies, and so also that either one and the same polarity shall affect both parts, or a positive polarity affect one part and a negative polarity the other, wholly irrespective of the distance between those parts and of their relative positions.

7. The producing a long-continued effect of one, or principally one, polarity only on certain parts of animal bodies, by means of portable transversal magnets, or by portable magnets applied perpendicularly or at right angles.

8. The application of galvanic currents (generated by the portable galvanic apparatus described under the third head) to exert a magnetic influence on animal bodies (as explained under the fifth head), by certain peculiar modes or methods, the description of which forms the eighth or last head of this specification.

Improvements in the manufacture of baths and wash-tubs, or wash-vessels. FRANCIS TONGUE RUFFORD, ISAAC MARSON, and JOHN FINCH. Sealed November 24, 1849.

The patentees describe and claim:—

1. The manufacture of baths in one piece by the following means:—

Five parts of fire-clay are ground up with one part of potsherds, and the whole tempered and prepared as usual. The finer portions are separated from the coarser, and both are made into rolls. The fine clay is moulded on a board of the size of the bottom of the intended bath, which is fitted with edges to obtain the required depth, and after that the coarser clay rolls are laid on. After this, the bottom is turned over, the board removed, and a plug, covered outside with wet calico, or other fabric, and of a size of the body of the bath, placed on the surface lately occupied by the bottom board. The walls of the bath are built up round the plug—the fine inside and the coarse clay outside. If necessary, the walls are supported by boards, and whole is completed it is left to dry and stiffen. After which, the inside surface is dressed with knives and sponged, as usual, and coated with potter's body prepared by grinding and fritting.

50 parts China clay.
30 do. bone earth.
15 parts curret.
5 do. raw borax.

The patentees then take,

50 parts of this frit.
35 do. China clay.
10 do. blue clay.
5 do. flint.

The last compound is mixed and reduced to a powder; a portion to the size of cartridge powder, and the rest to as impalpable a powder as possible. The coarse body is well rubbed into the interior surface of the bath, and after that the finer body is applied, the surface being dressed in the usual way. In this state the bath is placed in a kiln, and gradually heated until it is well burned, and takes the appearance of "biscuit." The kiln is then cooled down, and the bath removed to be glazed, which may be effected by dipping the bath in a glaze—oiling it to prevent the glaze from adhering to the outside. Or the glaze may be brushed over the bath by first coating it with a compound of linseed oil and turpentine, over which, when dried, the glaze is to be laid. The glaze which the patentees use in preference is composed of—

5 lbs. calcined borax.
20 lbs. of Cornwall stone.
2 lbs. 8 ozs. whiting.
2 lbs. 8 ozs. chalk.
33 lbs. white lead.
13 lbs. red do.
3 lbs. burned flint.

When the interior of the bath is coated with the glaze, it is placed in the kiln, which is gradually raised to the temperature at which the glaze vitrifies. At this point, the kiln is cooled, and the bath withdrawn.

2. The mode of manufacturing wash-tubs and wash vessels is the same as that employed in making baths in one piece.

3. It is proposed to make plunging and other baths of bricks, blocks, or slabs, which are made of fire-clay, and have the sides intended to come in contact with the water coated with potter's body, and glazed in the same way as the baths just mentioned. When the blocks or slabs used are of larger area and less thickness than the ordinary bricks, they are to be made with projections at the back to admit of their being "bonded" with the common bricks in the course of building.

Improvements in the manufacture of sulphuric, sulphurous, acetic, and oxalic acids, and nitrates. J. B. ECARNOT. Sealed December 10, 1849.

THE patentee states that in manufacturing the acids enumerated in the title of his patent, a binoxide of nitrogen is formed, which combines with the oxygen of the air, and escapes in the form of hypo-nitrous acid, and is consequently lost. The latter is soluble in steam or water, and forms in addition binoxide, which has again to be converted. Now the present invention consists in subjecting the oxide, in a close vessel, to the conjoint action of air, steam, and water. For this purpose he employs a vessel, or hollow cylinder, composed of earthenware pipes, strongly linked together, and filled with pumice stone. The binoxide is conveyed to the top of the column, and is made to percolate through the porous substance, and meet a current of air, which is driven up from below by a fan or other blowing apparatus. Steam and water are also made to accompany and mingle with the binoxide in its passage through the close vessel.

Improved mode of compressing peat for making fuel or gas, and of manufacturing gas, and of obtaining certain substances applicable to purifying the same. FRANK CLARK HILLS, Deptford, Kent, manufacturing chemist. Sealed November 24, 1849.

The improvement in "purifying" gas consists in depriving it of its sulphureted hydrogen, cyanogen, and ammonia by passing it through the subsulphates of iron, oxychloride or the hydrated or precipitated oxides of iron, either alone or combined with sulphate of lime, sulphate or muriate of magnesia, baryta, strontia, soda or potassa, and mixed with sawdust, breeze or other absorbent material, which will allow of the passage of gas through it. The hydrogen will combine with the oxygen, forming water, and precipitating the sulphur; while the ammonia will partially combine with the water, and the rest be absorbed. When the absorbing materials become inert, they are revived by passing a current of atmospheric air through them, which drives off the volatile gases. The passage of air is created by connecting the purifier, for the time, to a chimney or other exhaust; and the rest of the ammonia is condensed by means of suitable apparatus placed in the pipes leading to the chimney.

Mr. Hills proposes to apply the waste heat of distilling retorts to the heating of what he terms "warming retorts," in which the coal is placed prior to distillation, in order to economise heat in the latter process.

To obtain an equable and intermittent supply of the necessary water to gas scrubbers, it is proposed to place above the puri-

fying vessel, a reservoir to receive the water from the source of supply. This vessel is made with a long opening at bottom, fitted with a slide valve, on the spindle of which there is a float. The end of the spindle is attached to a tumbling lever. As the water flows in, the float will raise the one end of the tumbling lever to a certain point, when the latter will suddenly fall over to the other side, and jerk open the valve, whereby a sudden but equable supply of water will be admitted to the purifier. When the outflow of water has brought the float down to a certain point, the tumbling lever will fall and suddenly close the valve.

The "improvements in obtaining certain substances applicable to purifying gas" consist in combining the chemical substances, as enumerated under the second head of the specification, with sawdust, breeze, &c., and exposing them to the atmosphere for the purpose of absorbing the oxygen.

Improvements in the production of heat and light in general. JOSEPH PIERRE GILLARD. Sealed November 22, 1849.

Claims.—1. The production of hydrogen gas by decomposing water in furnaces and retorts serving to distil coal.

2. A process for producing hydrogen gas and a small quantity of oxide of iron.

3. Illuminating by means of electro-magnets put in motion by any mechanical power.

4. Producing hydrogen and oxygen by means of magnets put in motion simultaneously by any suitable power, the two gases being collected in separate vessels.

5. Rendering platinum and other unalterable and unoxidizable metals illuminating by the combustion of hydrogen and oxygen.

6. Rendering platinum and other unoxidizable metals more or less illuminating by means of hydrogen, or of hydrogen and oxygen, and also of oxygen and hydrogen combined.

7. Illuminating by heating platinum and other metals to a luminous white heat by means of oxygen, burnt either alone or combined with hydrogen.

8 Deoxidizing ores by means of hydrogen, or of hydrogen and oxide of carbon, or hydrogen and oxygen combined.

9. A mode of producing pig iron and purifying metals.

Improvements in producing light. AMBROISE ADOR. Sealed November 24, 1849.

Gas is supplied from the top of the apartment into a vessel containing some hydrocarbon. A pipe which opens at top, above the level of the liquid, passes down through it, and terminates in a second spherical vessel placed above the glass chimney. From the latter vessel two pipes descend to the burner. When the burner is lighted it heats the lower spherical vessel, which, being of metal, transmits the heat to the second spherical vessel, and vaporises the hydrocarbon contained therein. The gas, on entering this upper vessel, mingles with the vapor of the hydrocarbon, and descends with it into the second vessel, where the two are heated before passing to the burner.

Claim.—Combining apparatus for vaporizing hydrocarbon with, and intermediate to, a gas burner, and the tube which supplies it with gas.

Improvements in the separation and disinfection of fecal matters, in the manufacture of manure, and in the apparatus employed therein. LOUIS NAPOLEON LEGRAS, C. E. Sealed Nov. 30, 1849.

The improvements sought to be secured under this patent embrace:—

1. Several constructions of fixed and moveable water-closets for effecting the separation of the solid from the liquid portions of fecal matters by opposing to their passage a series of curved surfaces, which are so arranged and combined that the tendency of the liquid to run down the curved surfaces, and of the solids to take a direct course, will cause them to separate, and be received into distinct vessels.

2. Various modes of constructing and combining a self-acting disinfecting liquid or powder case with fixed and moveable water-closets, so that the closing or opening of the door or seat, or the depressing of a step, will cause a sufficient supply of the disinfecting agent to be discharged on the fecal substances almost contemporaneously with their deposit.

3. A peculiar construction and arrangement of apparatus in combination with a wagon for emptying the receivers of fecal matters of their contents and transporting them to any required distance in which the air-pump for creating the vacuum in the wagon, to exhaust the fecal matters into the latter, is worked by the rotation of the axle of the wagon itself. And also in combination with this wagon a peculiar construction of valve, through which the fecal matters pass, which has for its object to prevent the escape of any portion of them, and unpleasant odor.

4. Various disinfecting compounds.

5. The manufacture of a manure resembling guano in its fertilizing qualities, which

is applicable to calcareous and alluvial soils, and which the patentee calls *urban guano*. It is composed of 200 lbs. of cattle dung; 100 lbs. of road scrapings, or street sweepings; 100 lbs. of marl; 100 lbs. of fecal substances; 100 lbs. of the residuum from the manufacture of schistus, or of peat, turf, or wood charcoal, ground to powder, or of soot; 20 lbs. of marine salt; 15 lbs. of saltpetre; 10 lbs. of alumina; 5 lbs. of sulphate of zinc; and about 10 gallons of water. The whole is intimately mixed together, moulded into bricks, and dried; after which it is reduced to powder, and spread on the ground when it rains, at the rate of about 60 bushels to the acre, and ploughed in. When applied a second season, about half the former quantity is used; and if this be done for several successive years, an excellent arable land will be thereby obtained, which will afterwards not require manuring oftener than once in three years.

6. An arrangement and combination of apparatus for filtering sewage waters, in which the fecal matters are at the same time disinfected and precipitated.

7. A construction of public urinary and refuse water-sink, in combination with an apparatus for discharging a liquid disinfecting agent, to prevent the accumulation of alkaline and fatty deposits.

8. A peculiar construction of lifting and forcing pump for transferring fecal matters from their receptacles to a wagon or cart.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

SANITARY NOTES.

NO. VII.

THE past month has been prolific in official Reports of general interest. A report from the Building Committee for the International Exposition; a report from the Board of Health respecting the water supply of the metropolis; and a report from the Royal Commission appointed to make enquiries relating to Smithfield market and the other meat markets in the city of London, form a triad of great public interest both in their subjects and degrees. The first concerns the whole world, the second the most important city of the world, and the third the most wealthy and most powerful portion of that great city.

With respect to the first report it may be only remarked in this place that out of 245 plans sent to the committee from various parts of Europe, they have specially commended only 18 (of which 15 are by foreigners) which in every case are drawn up in complete breach of the conditions put forward by the committee for the guidance of competitors. When Englishmen were told not to enter into elaborate ornamentation, they complied; and the consequence is, they have been unjustly snubbed; and cause has been given for the remark of the *Builder*: "In the first round of the fight, England has gone down."

Of the second and third reports, the sanitary importance is equally great; and the innovation recommended is perhaps greatest as regards the latter one; of that therefore notice will first be taken.

The prescriptive rights required by an unchallenged possession of seven centuries, are to be annihilated; and Smithfield, which in the 12th century was a green outskirt of the metropolis, and in the 16th century was within the city, but on its outermost limits, is in the 19th century in the centre of a crowded population of 2¼ millions of souls. In the 12th century it was hunting ground, where the free animals had at least a chance for their lives; in the 16th century it was the site for the judicial murder of many thousands, who rather died than deny their own peculiar form of faith in the mighty Giver of all life; in the 19th century it has been the constant scene of agonies unutterable, inflicted by the debased image of God upon speechless but sensitive animals.

Smithfield market and its adjuncts can exist no longer, than until an efficient substitute for them is erected.

But the Smithfield question is not one of humanity only; it is also eminently a sanitary question: and, as usual, sanification and economy are twin sisters here.

One witness before the Commission, a principal butcher in London was asked:

"Q.—Is it the fact, that in consequence of the animals being urged by the drovers in coming to the market and in going out of it, they are much heated?"

The answer was,

"They are very much heated and damaged in the flesh; the muscle is interfered with, and rendered much less valuable than it otherwise would be. In taking away the beasts and the sheep from Smithfield market on crowded days, the difficulty there is of getting them away, subjects the animals to such cruelty, and to such overheating, that I have no hesitation in declaring that on some occasions when I have bought the best that money could buy (according to my judgment) in the market, I have had whole lots of stock (of sheep more particularly) from which I could not select a superior joint of meat to send to any one of my best customers. I have found that to be the case several times. But I must not ascribe the entire of that to Smithfield market. The sheep, well fattened at a period of the year when they have a heavy fleece upon them (those that walk up to market) encounter a great deal of fatigue and inconvenience from being so travelled, and they come into the market without being properly rested; then superadded to that fatigue and inconvenience is the market distress they are subjected to; these, with the drift home, leaves them at last in the state I have described."

Another butcher says,

"Mr. Slater told me that the reason he buys so largely in the country is, that he could not get sheep from Smithfield that would furnish him with mutton to please his customers; that the saddles of mutton, or the haunches of mutton, are so frequently bruised and goaded. At the end of their sticks they have a goad, which penetrates through the skin and flesh, and it causes pain and injury to the meat."

"Q.—Is the quality of the meat injured by the treatment which the animals receive in Smithfield market?"

"A.—I consider so."

"Q.—There is a deterioration in their value?"

"A.—It is an injury to the grazier or owner; it is a loss to the butcher and a loss to the public."

The following extract is from the evidence of another butcher and grazier:

"Q.—You have spoken of the deterioration of the cattle that takes place in consequence of their coming into Smithfield market. Did you ever calculate the loss of the stock annually brought, by ill usage or driving, or from the manner in which the business is conducted in the market?"

"A.—Yes; I have calculated it, and have no doubt that the loss sustained annually, in consequence of the bad arrangements of the live and dead meat markets in the metropolis, amounts to £200,000."

"Q.—By whom is that loss sustained?"

"A.—By the graziers and the public."

"Q.—Will you be good enough to state how you prove it?"

"A.—I will first take the loss to the graziers. It is estimated, and I believe correctly, that the returns of Smithfield market are £7,000,000 a year. I take that two per cent. on that sum would give £140,000 a year as loss to the graziers."

"Q.—How did you arrive at that?"

"A.—There are large quantities of beasts and sheep turned out of Smithfield market unsold on many market days; on these animals the loss is very great, they waste so much. On all animals the loss is considerable, from the fatigue and injury they undergo there. Their appearance is so bad, that a bullock of eighty stone would appear about seventy in Smithfield. Then the arrangements for showing the stock are very bad, and there can

be no doubt that the loss to the grazier is full two per cent. on all animals sent there. The next loss is to the butcher, and consequently to the public, from bruised meat, which is very considerable; taking it at 3d. per head on sheep, and 1s. 6d. per head on beasts, will give a loss of from £30,000 to £40,000 per annum. There is also a very great loss from the animals being kept by the butcher after he gets them home. He leaves them a few days, hoping they may get settled and fit to slaughter; but from the injuries they have received in Smithfield, they moan and waste, and get worse. Then, again, the butcher after purchasing, finds the weather unfavorable for slaughtering, which induces him to keep them alive: this also occasions great loss, and likewise the meat is much deteriorated. Great losses are likewise occasioned by the bad arrangements of Newgate market, from the close, unventilated shops where the meat is exposed for sale; the slaughter-houses in the cellars being underneath and the families residing above, necessarily prevents any air from reaching the shops; the consequence is, that meat spoils twenty-four hours sooner than it would in a well ventilated market. This, if only for five or six months in the year, occasions another enormous loss to the public. This, I believe, will fully make out the loss estimated. There are likewise many other losses and expenses the butchers are put to, which may to some extent account for the difference between the low price of stock in Smithfield, and the prices of meat to the London public. It is well known that Smithfield is the cheapest live cattle market in England, and the offals here bring more than anywhere, and yet the public in London are paying considerably more for their meat than in the country."

A large grazier was asked:—

"Q.—Did you ever form a calculation of what would be the difference between the value of a beast at Ockendon and its value in Smithfield market?

"A.—If I were a butcher, instead of a farmer, I would give from 10s. to 20s. more for a beast, buying it at a farm house to be delivered at my shop in a proper state, than I would give if the beast were subjected to the ordeal of going through Smithfield market."

Again:—

"Q.—At what should you put the difference in the value of the sheep sold in the country and the sheep sold in Smithfield market?

"A.—I should say it would make a difference to the butchers of fully from 1s. 6d. to 2s. a head, or more, which would amount to upwards of £100,000 upon the sheep alone."

Again:—"I am in the habit of killing my own sheep and sometimes in the hottest weather in the summer, and I have had mutton at the end of seven days as sweet as at the end of the first day; and I have sold sheep of the very same description in Smithfield, and I have heard the butchers say they have become green in 24 hours. There is an immense loss consequent upon that to the community, and which, I think, ought to be saved in some way or other. Meat killed in an excited state is not only flavorless, but not nutritious."

Then, with respect to the sale of diseased and injured meat, the last witness was asked—"Would any amount of diseased meat find purchasers?" He answered—"Yes: I am certain that if 100 carcasses of cows were lying dead in the neighborhood of London, I could get them all sold within 24 hours; it don't matter what they died of." Another witness, a butcher, says, "I believe any quantity of diseased meat would find buyers."

It results from the concurrent testimony of nearly all the witnesses, that the most horrible cruelty is practised, and, in part, necessarily practised, to bring up the animals for sale in the confined area of Smithfield; and the practices of severely beating and goading them produces such feverishness in the meat, that it becomes in many instances totally unfit for food, and yet it

always commands a sale for food; and in all cases the evidence of the first-named witness when examined before a Committee of the House of Commons, in 1828, is still applicable:—"Every butcher will admit that nothing can be killed out of Smithfield market on the Friday, for the use of the public on Sunday, that is in a fit state for slaughtering; every animal that is slaughtered on Friday is unfit, and in an improper state to be slaughtered."

A country tanner calls hides from the London market, "Smithfield cullenders;" so riddled are they.

But the sanitary evils of live meat markets in the heart of a city are not confined to the deterioration of meat from ill usage of the animals, nor even to the large and certain sale of diseased meat; greater evils even than these are caused by the presence of slaughter-houses, bone boiling, gut scraping, tallow melting houses, and all such sure concomitants to a live meat market.

The following extract is from the evidence of an Inspector of Sewers:—

"Q.—Do you know, from your own experience, that the air which escapes from the gulley holes in the vicinity of slaughterhouses and meat markets is more offensive than the air which escapes from gulley holes in other parts of London?

"A.—I know that the sewers receiving matter from slaughterhouses and meat markets are peculiarly offensive; I have traversed a very large number of sewers, and find this to be the invariable condition.

"Q.—Do you find, in traversing the sewers, a great difference when you approach a slaughterhouse?

"A.—Yes; even when one butcher kills, you can smell it very strongly in the sewer, if there is not a good current of water to carry the refuse sent into it away at once."

The next extract is from the evidence of Mr. Dunhill in examination on the subject of abattoirs:—

"Q.—Have you anything to state as the result of your own experience?

"A.—I can state for a fact, that the present slaughterhouses occasion an immense deal of cruelty, nuisance, and filth, and subsequent disease in this metropolis, which it is imperative something should be done to abate. The drains from the slaughterhouses bring an immense deal of foul refuse into the sewers, which render them noxious and objectionable to a degree; the effluvia arising therefrom is very prejudicial to the health of the locality.

"Q.—Do you speak of that from your own experience?

"A.—Yes. I hold an appointment under the Metropolitan Commission of Sewers, and the officers who are employed in the sewers have frequently complained to me of what they suffer. One, who was engaged in a subterranean survey, handed me an extract from his diary, where he states, that, on Saffron Hill, where the public slaughter-houses, in connexion with Smithfield Market, have brought together a large number of manufactories for preparing the offal, all the sewers are in a most disgusting state. Here is the extract from his level book; the memoranda were made at the time he was traversing the sewers referred to.

"Q.—What is his name?

"A.—Mr. Medworth, Superintendant of Trial Works. He says, 'The stench at this part is disgusting in the extreme, occasioned by the refuse draining from the slaughter-houses, and from drains where animal refuse is allowed to decompose. The sewer is lined with all description of filth; the stench is horrible. The stream is red with blood from the slaughter-houses; in some places it is 1 foot 6 inches deep, forming filthy cesspools, from which, when we step in, arises the most disgusting stench imaginable. The invert is washed away; the stench is horrible; we are obliged to burn paper and rags to enable us to continue at work. The drains are large apertures, several of them 3 feet long; the privies directly over the same. The greater part of this sewer is under the houses.'

"So that the foul and deadly gases evolved must have arisen from the openings and filled the houses, which at once acounts for the defective sanitary condition of that locality. Mr. Medworth goes on to say:—

"This is one of the most disgusting and filthy sewers that can possibly be imagined, we were five hours in going to the end, a distance of only 10 chains and 10 links."

"And it appears they found an opening into a burial-ground, and there squeezed their way out through a hole, in fear of their lives from the condition of this sewer, which receives the refuse from the slaughter-houses, tripe, blood, and bone-boiling houses, gut-spinning manufactories, and the like, in the neighbourhood of Saffron Hill. The slaughter-houses which exist around Smithfield and their concomitants, the gut-spinning, bone-crushing, tripe-houses, and all that, I am very anxious to see removed entirely away from any populous district. It is proved by tables which I hold in my hand, and have been specially prepared by that indefatigable sanitary reformer Dr. Hector Gavin, that the locality referred to is the very worst in the whole metropolis, in a sanitary point of view."

The evidence received respecting the dead meat markets shows their strangely inconvenient and injurious state. In Newgate Market a large quantity of meat is constantly spoiled from the want of space for delivering and exhibiting it. It appears also that there is a regular and enormous sale in London of diseased meat sent up from the country. There are three insurance offices in London in which graziers can insure their stock from disease. It was the practice of these offices to send the insured animals dying from disease to their own slaughter-houses to be dressed and sent to the London markets. Until lately they were regularly consigned to a salesman in Newgate Market; but now the sale is made more privately, more in the slaughter-houses and private places out of the city.

In conclusion the Commission recommend that the live meat market be transferred from Smithfield to some site on the outskirts in near connection with the railways from the north—that ample airage should be provided in connexion with the market—that slaughter-houses constructed on good principles be erected near the said market—and that Newgate Market should also be removed to a more convenient spot, perhaps to a portion of the present Smithfield area. It may also be added that there are fair hopes that these arrangements may be carried out at once.

Thanks for the labors of five committees of the House of Commons, and thanks for the industry and energy of this Royal Commission! Smithfield cruelties will shortly cease for ever. Instead of cries of agony, we shall soon be permitted to hear on that spot the voice of happiness and gratitude for decent accomodations afforded to the now miserable denizens of filthy and over-crowded lodging-houses. The grazier will obtain better prices for his cattle, as being in better condition—the butcher will benefit by being able to kill the meat in a sound state—and the consumers will be able to procure better meat than at present, at much reduced prices.

The consideration of the Report on the Water Supply must be deferred. The information contained in it is of great value, though some of the conclusions may meet with strong opposition.

SKETCHES OF PHARMACEUTICAL SAVANS.

BY CORNELIUS CORKSCREW.

II. MR. JACOB BELL.

THE subject of this sketch is held in higher estimation than perhaps any other member of the Pharmaceutical Society by his professional brethren, in spite of his manifold misdeeds, and the injustice that they have suffered, and are suffering, at his hands. But mankind are willing to forgive injuries received when they believe the wrong-doer has erred rather from weakness of the head than hardness of the heart.

There is about Jacob Bell's manner and conduct an integrity and a generosity of purpose, that those who have smarted from neglect or have felt that his connexion with the Society has enabled him to promote his

own interests to their disadvantage, which induces them to believe that these evils arise not from any premeditated selfishness or ambition of his own, but from the false position in which the machinations of others have placed him. Holding this opinion ourselves, and knowing that of no professional rival should we feel so little reluctance to ask a favor, or from whom we should so readily obtain forgiveness for a fault, we cannot for the life of us write harshly our view of this man's proceedings.

In Mr. Bell's personal appearance there is little that would denote that he is a member of the Society of Friends, for he has for many years eschewed the drab-colored garb, which the facetious canon, Sydney Smith, has immortalized when castigating the repudiating Pennsylvanian quakers. His manners are cold, but not repulsive; arising from a phlegmatic temperament, and also, doubtless, from the freezing influence of the early education and the domestic habits to which the youth of his sect are exposed. A considerable trace of nervousness is manifest in his disposition, which is probably hereditary. Like most men trained in a similar school, he pursues any task which he is desirous of accomplishing with an unwearied industry and an undaunted zeal. This activity and perseverance have been fully exemplified by his exertions in behalf of the Pharmaceutical Society, and by his frequent defence of Druggists against the arbitrary nature of the stamp and excise laws;—hence he has been aptly styled, the Druggists' Attorney-General.

With a heart free from the petty jealousy of many of his colleagues, he regards with unalloyed satisfaction the intellectual pre-eminence of other men, and, were it not for the trammels by which he is surrounded, and that the generous impulses of his nature are stifled in their birth by the cold-blooded policy of his confidants, he would ere this have reaped the goodly fruit of an elevated sympathy. Having a just appreciation of his own abilities, he makes no pretensions to the character of a man of science, for which he deserves no small credit in this age of inflated Pharmaceutical noodledom. The limited calibre of a mind like his is incapable of taking within its range the vast details and accumulated theories of any of the modern sciences; but, nevertheless, were its energies rightly directed, he might accomplish, from application alone, much to the advantage of all, and with honor to himself.

Mr. Bell is a member of the council and an examiner of the Pharmaceutical Society. Much pain should we be be spared, if we could forget that he is editor of the Pharmaceutical Journal. However laudable Mr. Bell's motives may have been in establishing a journal professedly devoted to Pharmacy, in connexion with the Society, the advantages, if ever there were any, of this connexion have long ceased to exist. It has now become a foul blot on the purity of his escutcheon, and a leprosy which is eating into the very vitals of the Society.

There is nothing so dangerous to the safety of tyrannical rulers as the censorship of the Press, because it hides from the knowledge of the despot the warning murmurings of his people, who are perhaps on the eve of a revolt and a just retribution, and consequently prevents him from making timely concessions to the advancing requirements of the age, and remedying that which yesterday might possibly have been a good, and which to-day has become an intolerable evil. Thus it is with Bell's Journal—the recognized organ of the Pharmaceutical Society—a copy of which is supplied to every member and associate of the Society, by virtue of a monopoly he enjoys. The effect of this degrading monopoly is to render Mr. Bell indifferent to the intrinsic merits of his journal, and to induce him to foist, *usque ad nauseam*, his own views, and those of his supporters, whether palatable or not to his readers, on them, because whatever the character and value of its contents, they can have no influence on the number of copies sold. Moreover, he exercises a strict censorship on all papers sent by the members for insertion therein, either to their total exclusion, or until they are so emasculated by his pruning-knife as to deprive them of their virility. The consequence of the power which Mr. Bell thus unduly possesses is, that, however great the dissatisfaction entertained by any of the members, as regards the proceedings of the Society, or the character of the journal, he takes care that it shall never reach the eyes of those for whom it is intended by the medium of his journal. The tone of his journal is, as may be expected, crouching and obsequious to those in power. It only ventures to attack the sins of the small fry of chemists and druggists: it passes over the vile corruption in the shape of bribes to doctors for recommendation, upon which most of the largest chemists fatten. It cannot—it will not—know anything of this villainous system, whilst it attempts to crush and stigmatise a defenceless chemist, who issues a quack hand-bill, or is unwilling to hear the euphonious sound of the night-bell. It makes a wide distinction between diplomaed quacks and undiplomaed

quacks: in fact, it does not believe in the existence of the former, whilst it never loses a chance of denouncing the latter. It admires the skill which invented the formulæ for Pil: Aloes. Dil., Ung: Stimulans, Vin: Ferri et Quin: or Terchloride of carbon, or Liq: Hydriod: Hydr: et Arsenic; but would bring the vengeance of the law on the man who orders or invents Aquæ Amygd: Amar, Pulv: Strych: Co: or Amorphous Quinine. However we may compliment Mr. Bell on the modest estimate he has formed of his scientific acquirements, nevertheless we deem it highly culpable in such a man to assume the responsible duties of the editorship of what is, or ought to be, a scientific periodical. For, without scientific skill and experience, how can an editor discriminate between articles offered for acceptance, when, as they often are when of real value, unpretending, and, when of meretricious character, plausible and confident? What dependance can be placed on his reviews of scientific books, for the guidance of the student in making a selection thereof? It is a poor apology for the skilful and vigorous performance of this duty, to eulogise all works indiscriminately, from Gmelin's Handbuch to Gray's Supplement. The editor of a periodical should not only be a qualified judge, but also a public instructor. To accomplish this task, he ought to be in advance of his readers in his intellectual attainments, which, unhappily for the Pharmaceutical Society, is not Mr. Bell's position.

If we mistake not the spirit and the ability of the generation which has sprung up since the establishment of his Journal, he will ere long have to rue the exclusive and blighting influence which he has cast around his proceedings, in reference to men of modest merit. On Mr. Bell's papers, published in his Journal, we shall not indulge in much comment, for they are only what they pretend to be, practical: they appear to be written with the good-natured intention of filling up a vacuity. But we think his good nature would have been more profitably directed, had he enlisted, even by a bribe—which means, in this instance, that those who preach the gospel should live by the gospel—(a matter which we know is not fashionable amongst editors of scientific periodicals, poor devils!), some of the many scientific chemists of his acquaintance to have remedied the evil.

As we believe Mr. Bell to be an honest man, and have no reason to suspect the sincerity of his professions, we should have preferred an answer in his Journal, to the many complaints, and misstatements, as he calls them, which have been made from time to time respecting his Journal and the Society, without being compelled to run the gauntlet with himself and his *sincere* admirers at a Pharmaceutical meeting; an ordeal for which we have no particular predilection, being members of the Peace Society, and having a holy horror of Aaron Smiths. For example, we should like to be informed what advantage arises to the Society from its connexion with Bell's Journal? Whether the Council believes that there is no other man as capable and as willing as Jacob Bell to edit a similar Journal? If such a man, or a better, were to make an application to share the monopoly, in what manner would they meet the application? Or has Mr. Bell been granted the right in perpetuity of supplying the members with his Journal? Whether he has the power of bequeathing, selling, or mortgaging, his privilege of the monopoly? What are the grounds or conditions upon which the monopoly was originally granted? In what manner, stipulated or understood, was Mr. Bell to recompense his benefactors for the boon? How long he thinks his Journal would survive the monopoly? Whether he thinks the Society could exist independently of his Journal? Whether he believes that a man highly skilled in chemistry, botany, and other allied sciences, has a natural disqualification for occupying a high position in Pharmacy, or to reap its offices, honors, and rewards? Whether it is possible for a man who keeps a shop and edits a Journal, to forget the shop when he is editing the Journal?

As we do not wish to be hard upon you, friend Jacob, our questions must close here; but we have no partiality for having them burked in your Journal; therefore, having stated them, we will forgive you answering them, as every reader will be able to supply that deficiency. Withal, Jacob, we have a liking for thee. We yearn to win thy esteem and confidence. We believe that there is that kindly stuff in thee that, with more noble counsellors, thou wouldst do deeds for which thy contemporaries would encircle with laurels thy brow. But thou must emancipate thyself from old associations. Thou must not only be pure thyself, but turn a deaf ear to the impure whisperings of others. To rescue the Pharmaceutist who is qualified for his high calling by study, intellect, and self-respect, from the crushing corruption by which businesses are now made, and talent and independence of spirit are trodden to dust, would be a God-like labor for the energetic and genial Soul of Jacob Bell.

HISTORY OF PHARMACY AMONG THE GREEKS AND ROMANS.

BY M. CAP.

(Continued from page 421).

II.

As we leave the period at which the School of Cos flourished, and approach that at which the dogmatical and methodical schools reigned, we cannot avoid remarking that always increasing tendency towards an indefinite complication, which was introduced into therapeutics and pharmacy. The summit of art for a physician of that period, and sometimes the best element of his reputation, was the composition of an electuary, of an antidote in which he crowded a number of substances possessed of different properties, and thus capable of being applied to a great number of diseases. The physicians of the time believed that each medicinal substance possessed, relative to a given disease, an absolute curative property; but that this property was accompanied, with regard to the organs, with a physical action often contrary to its medicinal efficacy. Consequently, they accompanied each principal drug with several others, some to aid in its medical activity (adjurant), others to modify its influence on the organism (corrective); and their last care was devoted to the selection of the ingredients to be used as a vehicle (excipient) for all this mass, this strange chaos of which an electuary was composed.

It has often been stated that the word electuary is derived from the latin word *eligere*, to choose; however, Celius Aurelianus, who was nearly contemporaneous with Galen, places electuaries by the side of eclegmas, whose derivation I have already given, and he gives them the name of *eclectuarium*, which very probably became corrupted into electuarium.

As to the word antidote, it was a generic term, applicable to all compound medicaments. Galen termed antidotes all preparations administered internally; and the word *antidotary* was long employed as a synonyme of dispensatory or pharmacopœia. Afterwards, this word signified, as it still does, a counter-poison. At this period, there were antidotes to phthysis, contusions, colic, calculi, pleurisy, gout, &c. Galen divided them into three series: antidotes to poisons, to the bite of venomous animals, and to excess. In his opinion, the theriacum of Andromache united in itself these three properties.

The consistence of electuaries and of solid antidotes was nearly the same. Their taste was often disagreeable. Little balls (catapotia) of various sizes were made of them. Those which had the form of a seed or a pea were called globuli, globerami, and pilulæ; others were of the size of a small bean or lupin seed, and were called pastillæ (from pasta), and trochisci.

The names which the Greeks and Romans gave to their medicines often related to their use. Thus, they called *arteriacæ* arteriacals, those which were employed in diseases of the lungs and tracheal artery; *bechicæ*, those which were employed against cough. Pills intended to dissolve slowly in the mouth, and which were placed under the tongue, were called *hippoglotides*. The *eclegmas*, of a soft consistence, were composed of gum tragacanth or Arabic, of juice or powder of liquorice, myrrh, honey, wine, saffron, and sometimes diacodium or opium was added. They were then called *anodyna* or *paregorica*. The simple and compound powders were likewise ranked in the class of solid medicaments.

The liquid medicaments did not differ much from those of Hippocrates. The most commonly employed drinks were the infusions, decoctions, and juices of plants, more or less diluted. Sometimes a dose of the antidote was diluted with water, wine, or hydromel. Liquid medicines in general bore the name of *potiones*. Those which were obtained by decoction were called *decocta* and *apozemata*. Galen also gave the name of decoctam to a water which had been boiled and cooled in snow.*

These were drinks which could be taken in health as well as in disease: they were wine in which were infused absinthium, pepper, and casamum (a species of cyclamen); honey and other ingredients were added, which gave their name to these drinks; there was also water in which apples or roses had been boiled, and to which verjuice, pomegranate juice, myrtle berries, and honey were added.†

Drinks composed of honey, wine, and aromatics, were called *propomata*; Paul d'Egine and Nicolaus Myrepsus have preserved several recipes for these. One kind of propomata, which was drunk iced, bore the name of *recentatum*. Certain compound wines, which were called *condita*, were taken at the commencement of a meal to excite appetite.

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* Nero, at the hour of death, a fugitive, and obliged to drink, from the hollow of his hand, water out of a ditch, exclaimed: "Et hœc est Neronis decocta!" Suetonius, c. 48.

† See Paul d'Egine, l. 7, c. 15.

A mixture of four parts of wine and one part of honey was called *vinum mulsum*, or simply *mulsum*. *Hydromel*, composed of water and honey, was likewise called *aqua mulsa*. *Hydromelon* was formed of hydromel and quince juice; to make *hydrorosatum*, roses were added, instead of the quince juice; when these four substances were mixed, *rhodomelon* and *rhodostacton* were obtained. Modern pharmacy has likewise retained the name of *oxymel*, a mixture of honey and vinegar, as well as *oxycrat*, a mixture of vinegar and water. *Omphacomeli* was prepared with honey and verjuice, myrtites with honey, and the juice of myrtle berries, and rhoïtes with honey and pomegranate juice. Analogous preparations were made with most fruits. Apomeli was water in which honey had been boiled.

Among external medicaments, the *oils* held the highest rank. They were prepared by infusing simples in olive, nut, almond or sessamum oil. When this oil was very much impregnated with the active parts of the plant, the name of unguentum was given to it. This word was applied to everything that was used for anointing, but especially to the aromatic oils and liquid perfumes. The rose ointment, was most used.

The ointments were called also *acopa*, because they were often employed for relieving lassitude. The same name was applied to all the preparations which were used externally with the same object, such as mixtures of wax, honey, turpentine, various resins, and lard. Of this number was *cerelæon*, an almost liquid mixture of wax and oil. When they contained aromatics, they were called *myracopa*. The *cerate* contained not only a larger proportion of oil, but also various powders were added to it. According to Galen, the cereleon and acopa were the most liquid ointments: next came the cerates, and lastly the plasters. Paul d'Egine says, that *illitiones* were still more liquid than the acopa. The *oxyrhodines* were a mixture of honey and oil of roses.

The consistence of *plasters* was owing not only to their containing more wax than the cerates, but also to metallic powders being added to them, such as litharge, ceruse, oxide of copper or earths, chalk, bol, &c. The softer were called *lipara*, fatty plasters, or *parygra*, humid plasters. Those in which dry or solid matter predominated were called *alipanda*, plasters without fat, or amolyntha, which did not soil the hands. This last condition was the true characteristic of the consistence of plasters.

Small round cylinders of the length of the finger were formed of these plasters, and were called *magdalidæ* or *rotundæ*. These are our magdaleons. These malagma were a composition formed of gums, aromatics, salts, and other substances, the object of which was to soften and reduce tumors. A little wax, oil, or lard, was added, which made them resemble the plasters. Sometimes they were simply gums and resins dissolved in wine or vinegar. The word *malagma* extended also to other medicaments of the same consistence.

The epithem differed from plasters and malagma only in being applied, not to tumors or wounds, but solely to the skin, with the object of acting sympathetically or by absorption, often to the stomach, to strengthen it, or lastly to recent wounds, as an hœmostatic.

Besides the ceropissus, composed of pitch and wax, the dropax was a plaster which was applied to the epidermis, and which was violently torn off, so as to redden the skin or to denude it or to remove the hair.

Cataplasms, ordinarily formed of plants, flour, or crumb of bread, boiled in water or in other liquids, sometimes contained oil, honey, linseed meal, figs, barm, and several other substances, sometimes astringent and sometimes emollient. When it was desired to irritate the skin, powdered mustard or cantharides was added, and they were called *sinapisma*.

The *smegma* served to cleanse the skin, and even as a dentifrice. It contained bean flour, melon seed, hartshorn, pummice-stone, sepia, antimony, burnt lead, sulphur, sal ammoniac, nitre, alum; sometimes, staphisagria, hellebore, pepper, cardamums, gums, resins and juices of plants, the whole mixed with oil. The body was rubbed with it before going into the bath. Certain aromatic powders called *diapasmata* were rubbed over the body to absorb the perspiration.* When the smegma had the object of depilation, it contained orpiment, tragacanth, and quick lime, and was called *psilothron*. Among the opulent Romans, the slaves rubbed the bathers with smegmas composed of the rarest aromatics, brought from all parts of the world, and contained in vessels of gold, alabaster, or rock crystal. This was the *amoricinum*, *magalium*, or *nardum*, and a host of others, to the names of which were added the most marvellous epithets, as in the case of electuaries.

The *collyrium*, as with the Greeks, was a composition of solid consistence, round, four times the length of the finger, thinner at one end, and thus like the tail of a rat,

* Siccis odoribus constant quæ diapasmata vocantur. Plin., lib. 13, c. 2.

whence its name. Thus, this word was applied only to the form of the medicament, which might be composed of very various ingredients; the *tentes*, emplastic masses intended to be introduced into fistulas or natural cavities, were also called collyria. The same name was also given to mixtures which were dried in order to their better preservation, and which were ground when required for use. Of this number were also certain compositions used for diseases of the eye, and it was by extension that the name of *collyria* was given to preparations destined for this use.* *Dry* collyria contained metallic powders, such as ceruse, pompholix, verdegris, chalcitis, then saffron, myrrh, opium, aloes, juices of roses, fennel, chelidony. *Liquid* collyria were composed of honey, opobalsamum, vipers' venom, or pale wine and fennel juice.

The *trochisci* were small masses to which various forms were given, most frequently the demi-orbicular form, and which should not weigh more than a drachm. Some were intended for external use, and had nearly the same composition as the *collyria;* others were administered internally.—They were placed in the mouth *(pastilli)* to perfume the breath;† others were burned as perfumes. The trochisci *hedychroi* (of agreeable color) were composed principally of aromatics. The mass of which they were formed was called the *massa hedychroum.*

Independently of the *gargarisma*, medicines intended to be injected were called *clysma*. Those which were breathed by the nostrils were called *errhyna.*

We have said that, from Hippocrates to the time of Galen, the materia medica was enriched with a very great number of new agents. It was during this period that Dioscorides and Pliny collected the numerous documents of which the history of the materia medica of antiquity is composed. As to the pharmacy of the same period, it is found entire in the writings of Galen, which comprised those of Celsus, Andromache, Asclepiades, Pharmacion, Archigen, and of all the authors who preceded him, on the same subject. Besides the substances derived from two organic kingdoms, many already were obtained from the mineral kingdom. Several salts and metallic oxides entered into the composition of medicaments. They administered internally several kinds of salts, powdered gums, earth of Lemnos, Jew's stone (points of fossil shells found in Palestine, and which were employed against strangury), the stone hœmatite, common salt, nitre, sal ammoniac, fossil salts, potassa (which was obtained by incinerating rushes and reeds and lixiviating their ashes), theriacal salt and vipers' salt (the preparation of which is given by Pliny and Dioscorides), lastly, purgative salts, probably tartrates, whose activity was increased by adding scammony.

The mineral waters enjoyed a very high reputation. They were used as baths, and taken internally. Archigen classed them, according to their constituent principles, into sulphurous, bituminous, aluminous, and saline waters. They were also employed in calculous affections.

The pharmaceutical operations were scarcely more complicated than in the time of Hippocrates. However, Galen mentions the sand-bath, which he called *diplangium, diploma*, and *vas duplex:* he was acquainted with sublimation and distillation *per descensum.* We have also said that at this period the ambix was known, from which the alembic was afterwards derived. Some of the utensils of this period differed very little from ours. They used mortars, grinding stones, sieves, knives, scissors, rasps, spatulas, presses, basins, and preserving vessels of every form. All the progress of art in this latter time seems to be concentrated on one point, that of combining in various proportions, and with a great reinforcement of accessories, the most heterogeneous agents, with the view of attacking, at a single blow, the most varied affections, and even to combat before-hand, by preventive means, morbific causes which did not exist.

To be continued.

* Hic oculis ego nigra meis collyria leppus,
Illinere.....
Horat., lib. 1, sat. V.

† Ne gravis hesterna fragres Fescennia vino
Postillos Cosmi luxuriosa voras.
Martial., lib. I., epigr. 88.

NECESSITY OF MEMBERS OF SOCIETIES GIVING NOTICE OF WITHDRAWAL, WHEN SUCH NOTICE IS REQUIRED BY THE BYE-LAWS.

A RECENT decision of the Judge of the Westminster County Court having settled that it is necessary for a member of a society to give notice of his withdrawal, when a bye-law to that effect exists, we hasten to remind such of our readers as may belong to any society that, if they wish to withdraw from it, they must immediately give notice in writing of their intention; otherwise they may be called upon to pay up arrears, and the payment enforced with the agreeable accompaniment of law costs.

This is a matter of considerable importance to our readers, as, doubtless, the Pharmaceutical Society will profit by the decision obtained by the Royal Agricultural Society of England.

MEANS OF DISTINGUISHING ARSENICAL FROM ANTIMONIAL STAINS.*

BY H. ROSE.

PROFESSOR ROSE recommends the two following processes for arriving at the solution of this important problem. Supposing that the black deposit furnished by Marsh's apparatus, forms a more or less considerable ring in the interior of the tube, this tube is cut at the part where the sublimate commences, and it is deposited in a glass vessel containing a small quantity of chlorate of potassa, and sufficient hydrochloric acid to completely moisten the metallic deposit. Arsenic immediately dissolves in the chlorine which is disengaged; antimony resists longer, but is ultimately dissolved. It is sufficient to heat moderately, without boiling the liquor, otherwise the chloride of arsenic might be volatilised. Tartaric acid, muriate of ammonia and ammonia, are afterwards added to the solution, which should not cause precipitation. The arsenic acid is then precipitated by means of sulphate of magnesia, and the ammoniaco-magnesian arseniate collected in a small filter, and washed, may be reduced in a tube by means of a mixture of cyanide of potassium and carbonate of soda, furnishing a metallic ring consisting of pure arsenic.

The ammoniacal liquor, precipitated by sulphate of magnesia and filtered, contains the antimonic acid, whose presence is rendered evident by supersaturating this liquor with hydrochloric acid, and adding sulphuretted hydrogen which precipitates the antimony under the form of orange sulphuret.

When the stains or deposits to be examined are very thin, it is impossible to apply this process. Professor Rose then recommends dissolving them in hydrosulphate of ammonia, evaporating the solution to dryness at a gentle heat, and examining the solid residue formed of yellow sulphuret of arsenic or orange sulphuret of antimony, or of a mixture of the two: for it is always possible to distinguish and even to separate these sulphurets with the aid of a drop of hydrochloric acid, which very readily dissolves the sulphuret of antimony, without attacking the sulphuret of lead.

* *Journal de Chimie Médicale*, June, 1850.

ON THE ODOROUS PRINCIPLE OF THE LEAVES OF FAHAM.*

BY M. GOBLEY.

THE leaves of faham, known also under the name of leaves of fahon or fahum, come to us from the Mauritius. They are furnished by a plant which Dupetit-Thouars first described, and to which he gave the name of *augræcum fragrans;* it belongs to the gynandria monogynia of Linnæus and to the monocotyledons epigynia of Jussieu, family of orchidiæ. Like many exotic orchidiæ, faham is a parasite. It is a pretty plant, which is in great demand among the Arabs on account of its odor. It is sufficient to touch the fresh leaves for the fingers to become impregnated with their odor. The dry leaves, as met with in commerce, possess an odor analogous to the perfume of vanilla, which belongs to the same family of vegetables. Alcohol and ether separate its aromatic principle. They yield to boiling water, besides the aroma, a slightly bitter principle and a mucilaginous substance. In the country from which they come, and even in France, an agreeable tea is made from them which is employed as a digestive, and recommended even in diseases of the respiratory passages. Mixed with ordinary tea, they communicate to it a very agreeable perfume.

Being struck with the odor of these leaves, I made some investigations to discover the principle to which it is due. After many attempts, the following is the very simple process by means of which I have been enabled to separate it.

The leaves of faham reduced to a coarse powder are introduced into a displacement apparatus, and lixiviated in the ordinary manner, with alcohol at 85 centesimal degrees. The alcoholic extract obtained, after the distillation of the alcohol, is introduced into a flask with the quantity of water necessary for giving it a syrupy consistence; it is then agitated with ether, which is replaced until it is no longer perceptibly colored. The ether, being evaporated, leaves a greenish and very odorous substance. The aromatic principle which it contains is separated by means of boiling water; the filtered liquid gives crystals on cooling; but as these still possess a greenish tint, they are purified by dissolving them several times in boiling water; finally, they are completely decolored by means of animal charcoal. The crystals obtained are placed on a filter; they readily dry in contact with the air.

The aromatic principle of the leaves of faham is therefore a crystallisable body. It

* *Journal de Pharmacie*, May, 1850.

is under the form of small white and silky needles, or short prisms terminated with bevils; these crystals give an aromatic odor resembling that of faham and somewhat those of bitter almonds and melilot; the odor is developed especially by rubbing between the fingers; their taste is at first slightly bitter and afterwards pungent. To enter into fusion they require a temperature of about 250° F.; they are difficultly soluble in cold water, but boiling water readily dissolves them and deposits them on cooling; they are very soluble in alcohol and ether.

Is the crystalline matter which I extracted from the leaves of faham a new principle, or a substance which has already been met with in other vegetables? After a careful examination, I have found that the body which it most resembles is coumarine, discovered by Guibourt and Boullay, in the Tonquin bean (*coumarouna odorata*) and found in the melilot (*meliuotus officinalis*) by M. Guillimette, and in the *asperula odorata* by M. Kosman; but are these substances identical? It was this that I had to determine.

The odor of coumarine is very analogous to that of the crystalline matter of the leaves of faham; both substances are very difficultly soluble in cold water, and dissolve very readily in boiling water, from which they separate by cooling in crystalline needles. Both are soluble in all proportions in alcohol and ether; but they appeared to me to differ in taste, which, in the principle of the leaves of faham is at first bitter and then pungent; whilst that of coumarine is extremely pungent without being accompanied by the slightest bitterness. The point of fusion also establishes a considerable difference between them; coumarine, it is said, is fusible at 122° F.; the crystalline principle of the leaves of faham fuses at 250° F. As the fusing point of bodies is an important character in chemistry, I prepared coumarine from melilot in order to compare it with the body I had discovered. I treated the melilot as I had done the leaves of faham, and thus obtained perfectly similar crystals; they presented a slight bitterness, and fused at about 250° F. The true fusing point of coumarine is not therefore 120° F., and it must have been falsified by traces of the fatty matter which exists in large quantity in the Tonquin bean. As to the slight bitterness which the crystalline principles of the melilot and faham possess, it is due to a small quantity of the bitter resinous substance existing in those vegetables.

Finally, to prove the perfect identity of the two bodies, it only remained for me to analyse the crystals which I had extracted from the leaves of faham.

0gr. 310 of this substance fused gave:—carbonic acid 0gr. 872, and water 0gr. 121, which gives in hundredths,

Carbon	76·12
Hydrogen	4·12
Oxygen.....	19·76
	100·00

M. O. Henri found the composition of coumarine obtained from the melilot and Tonquin bean to be:—

Carbon.....	76·30
Hydrogen.....	3·90
Oxygen.....	19·71
	100·00

The crystalline proximate principles which are extracted from the Tonquin bean, melilot, asperula, and faham, are therefore one and the same body.

Coumarine is a curious substance, not only because it has been found in several dicotyledonous vegetables, but also because I have discovered it in a monocotyledonous plant.

When we examine comparatively coumarine extracted from these various sources we find that, apart from an odor common to all, there is a slight difference in each of them, owing, doubtless, to each of them retaining traces of other odorous principles which accompany them in each of these vegetables, and whose combination determines the variations which enables us to distinguish these odors however similar. Might I not, then, ask myself, on account of the analogy which exists between faham and vanilla, both botanically and as regards odor, if the crystalline substance which forms the frost of vanilla may not be coumarine? Dr. Vogel at first thought that it was benzoïc acid, but then it was ascertained that it did not possess acid properties. I will publish the result of the investigations which I intend to make in this respect if I can procure sufficient frost of vanilla to subject to accurate experiments.

USE OF COD-LIVER OIL IN PHTHISIS PULMONALIS.*

BY DR. REESE.

THE advanced period of tuberculous phthisis in which most of our patients reach the hospital, affords but slender encouragement

* *American Journal of Medical Sciences*, 1850.

from predication. In those, however, with whom any rational hope could be indulged from treatment of any kind, the cod-liver oil has been frequently and extensively employed, and many of the patients have improved under its use, and been discharged from the hospital, so that their subsequent history could not be traced. The apparent effects have been an improvement of appetite and strength; diminution of cough, expectoration, diarrhœa, and night sweats, with the establishment of regularity in the alvine evacuations; but further experience will be required to estimate accurately the powers of the remedy. The crude and clarified oils have both been tried, though preference is given to the latter. From a teaspoonful to a tablespoonful has been given three times a day.

EMPLOYMENT OF OXYGEN AGAINST THE ACCIDENTS CAUSED BY CHLOROFORM AND ASPHYXIA.

BY M. DUROY.

THE author had observed that when chloroform is prepared oxygen is abundantly produced, and is saturated and carries away a considerable proportion of chloroform. Moreover, he remarked, that this gaseous mixture might be respired with impunity, and he inferred from this that oxygen gas might probably be employed with advantage for remedying the accidents caused by an ill-managed inhalation of chloroform. This conjecture led him to undertake the researches, the results of which he now presented to the Academy.

M. Duroy proposed to solve, by experiments, the three following questions:—1. Does the introduction of oxygen into the air passages present any danger? 2. Does oxygen respired at the same time as chloroform destroy the action of that agent? 3. Is oxygen capable of remedying the effects and accidents which follow the employment of chloroform? The results given in this memoir seem to reply to this question in the affirmative. The author is paying attention to the application of oxygen in the asphyxia produced by the gases of charcoal. Finally, he is endeavoring to point out the most convenient mode of applying this therapeutical agent in cases in which it is required.

* *Comptes Rendus, No.* 17, April 29, 1850.

CASE OF POISONING BY METALLIC ARSENIC.*

BY B. SILLIMAN, JUN., M.D., PROFESSOR OF CHEMISTRY, ETC., IN THE UNIVERSITY OF LOUISVILLE, U.S.

THE man had been unwell for some days with symptoms supposed to be occasioned by simple derangement of the bowels, accompanied by nausea and vomiting. The medical attendant was called on Thursday evening, Aug. 30, and found the patient in bed. He complained of nausea, thirst, and constant distress at the stomach, and pain in his bowels; pulse feeble and irregular; his hands cold. He was treated with Hopkin's elixir, followed by Dover's powders, camphor, gum, and sudorifics: the following day he appeared easier, and was in a perspiration. Still complaining of his stomach, an emetic was administered of Antim. Tart. grs. ij., Pulv. Ipecac. grs. xx.; which, failing to act, was repeated—each in three doses. He was not seen again until nine o'clock on Friday night, when he was in a state of collapse, with great distress in the stomach and great difficulty of breathing; pulse not perceptible; hands and feet cold and livid. He complained of extreme heat in the pit of his stomach, and conversed with difficulty; had a constant disposition to vomit, general twitching of the muscular system, and frequent alvine discharges; countenance pallid; skin cold, and bedewed with a clammy sweat. Diffusible stimulants were administered, and he died about midnight following, say thirty-six to forty hours from the time he was first seen by a medical attendant.

The autopsy detected nothing remarkable in the upper viscera. The stomach, however, showed distinct marks of inflammation by a medial ring of vermillion red extending around it: below—say three-fourths of the organ—was dark, nearly black, colored; the upper portion healthy. It does not appear that the alimentary canal was examined. The appearance of the stomach, which had been preserved in alcohol, was fresh, no change or decomposition having taken place; nevertheless, it appeared of a livid and unnatural color. A strong horizontal line divided it into two equal portions; the lower portion being dark, the upper opaque, and not unnatural in its appearance. The stomach was opened by a long incision, and its interior exposed. Its internal appearance was strikingly unhealthy, livid, and inflamed, resembling

* *British American Journal*, p. 298, March, 1850.

the effects of acute gastritis. Its contents appeared singularly unnatural, being not less in quantity than one pint of dark colored brownish fluid, thick, and resembling in color and appearance rich chocolate. The line of division already spoken of was not so apparent on the interior as on the exterior. The whole interior surface presented strong evidence of inflammation; the color was livid, with lines of extravasated blood. The mucous coat was lined with the chocolate-colored matter before mentioned. There was no trace of food in the stomach, save a few filaments of reddish matter resembling the skins of tomatoes.

Arsenic was readily detected in the stomach, both in the metallic state and in a soluble form. The deceased had probably swallowed the substance called *fly powder*, but the circumstances under which the poison was procured and taken are not stated in the report.

NEW HOMŒOPATHIC DODGE.

UNDER this title, in our May No., we noticed an advertisement offering to initiate Ladies and Clergymen, for charitable purposes, into the dangerous practice of Homœopathy. We have since made ourselves acquainted with the Advertiser's terms. His object, he says, is to "disseminate the science" of homœopathy, and, he adds, "I am willing to give my assistance at as low a rate as possible." He charges 10s. 6d. per visit. He keeps his name secret, using the initials H., M.D.

Of course, the fellow's real object is to pocket as many half-guineas as he can persuade the "Ladies and Clergymen" to give him. Certainly he has selected those of Her Majesty's subjects least likely from knowledge of the world to be safe from his scheming.

IV. REVIEWS, NOTICES OF BOOKS, &c.

The Quarterly Medical Recorder; being a Digest of the Progress of Practical Medicine, Surgery, Obstetricy, Medical Jurisprudence, and Pharmacy. Part I. Feb. to May, 1850. London: Underwood and Co. Price 1s. 6d.

This work gives short abstracts (alphabetically arranged) of all the articles contained in the medical periodicals published within the quarter. Those whose time will not admit of their wading through the immense amount of matter published by our excellent medical press, will be enabled by the Recorder, to select for perusal such papers as may appear sufficiently interesting to attract their notice, and the unfortunately large class of non-readers will probably be led into reading farther by this work, and thus we hope that all our medical contemporaries will arrive at increased circulation.

The Medical Recorder eminently deserves the support of the medical profession, and we hope that it will meet with the success its utility merits.

TO CORRESPONDENTS.

"T. W. N."—Messrs. Horne, Thornthwaite and Wood, we think would be the best persons to apply to. Messrs. Heathfield and Burgess are the largest makers, but their business is wholesale.

"M. P S."—We recommend you to write to the Secretary, as you propose, and that without delay.

We have received numerous letters grumbling at the injury done to other members of the trade by Mr. Bell, himself a retailer, having the monopoly of the Pharmaceutical Journal. To these correspondents we reply that the remedy lies with themselves. We are acquainted with the evils and injustice of the thing, and have pointed them out; our correspondents should act instead of writing. If any man of decent pluck will set the example, he will find plenty of assistance. We really think that people deserve all they suffer, if their remedial measures are confined to grumbling. If all the discontents will give us their names, we will endeavor to organise their proceedings.

"MR. FLEMMING."—We do not know of any translation of Runge's "Farbenchemie."

Numerous correspondents have been answered by post.

NOTICE.—*All Communications, Books for Review and Substances for Notice must be addressed* "To the Editors of THE CHEMIST, care of Messrs. W. & T. Piper, Paternoster Row, London." *Communications for insertion must be prepaid, and sent before the 15th of each month. Letters requiring a reply in the following No. will in future be received as late as the 24th.*

THE CHEMIST.

[NEW SERIES.]

I. CHEMISTRY.

ON THE COMPOSITION OF CORN.*

BY M. PELIGOT.

(Continued from page 438.).

NITROGENOUS MATTERS.

IT is generally considered that the nutritive value of aliments may be estimated according to the proportion of neutral nitrogenous matters which they contain: consequently, I have attached great importance to accurately determining this proportion in the kinds of corn which I have studied.

The only process which can be regarded as accurate is that which consists in calculating the proportion of nitrogenous matters from the quantity of nitrogen which they furnish, either in the state of gas or under the form of ammonia. My former analyses were made by employing the old process, namely, by collecting the nitrogen in the gaseous state. Afterwards, having made some modifications in Will and Varrentrapp's process, which render it more rapid and more practical without interfering with its accuracy, I estimated the nitrogen by collecting in a known volume of sulphuric acid of known strength the ammonia arising from the combustion of corn with a mixture of caustic lime and soda, and by determining by a measured solution of saccharate of lime the quantity of sulphuric acid saturated by the ammonia, and, consequently, the quantity of that ammonia. It was only after numerous synthetical and comparative experiments that I adopted this process; now, that a long experience has enabled me to appreciate its results better than at the period at which I made it known to the Academy, I think I am in a condition to affirm that, not only is its execution infinitely more easy, more prompt, and less expensive than that of the old process, but even that its results are, in general, more accurate. The process of estimating nitrogen by the separation of that body under the form of gas presents, indeed, the inconvenience of generally furnishing more gas than the nitrogenous substance analysed contains. This excess of gas, which is sometimes hydrogen, sometimes binoxide of nitrogen, sometimes even nitrogen arising from the air of the tube when it has not been completely exhausted of air, ordinarily a mixture of these gases, is produced in circumstances which may be obviated by care and precautions, but which become almost unavoidable when a long series of analyses has to be executed. When it is required to determine the composition of pure nitrogenous substances, containing at least 15 or 16 per cent. of nitrogen, this excess of gas does not perceptibly influence the result, for it produces an error of only a few thousandths more in the estimation of the nitrogen. But it is not the same in the case of organic substances which, like corn, contain only 2 or 3 per cent. of nitrogen; for, as this excess of gas represents a constant cause of error accumulated in a small quantity of gas, it causes in the results of the analysis a perturbation which is so much the greater as the substance itself contains less nitrogen. Besides, the nitrates contained in certain vegetables furnish, by this process, nitrogen which counts with that which belongs to the organic substance, and it is well known that there exists no means of separately estimating these salts when they are

* *Annales de Chimie et de Physique*, May, 1850.

found in very small quantity in plants. The process which I employ does not furnish in the state of ammonia the nitrogen contained in the nitrates. The latter are not decomposed, at least so as to form ammonia, by the alkaline mixture used for burning the organic substance.

For all these reasons, I am induced to believe that the determination of nitrogen, and, consequently, of the nitrogenous principles of vegetables, is more accurate by the method which I have employed than by that which is commonly used. I doubt not, moreover, that it will entirely replace the old method, except in the rare cases in which it occurs in the state of nitric acid, hyponitric acid, or of any other oxygenous compound. All the chemists who have adopted the process which I have followed, coincide in its accuracy and in its simplicity of execution, which is, in all respects, comparable to that of an alkalimetrical test. I may add that a work which includes a numerous series of estimations of nitrogen, like that which I now present to the Academy, becomes so long, tedious and expensive, when the nitrogen is estimated in the state of gas, that its execution becomes, if not impossible, at least very difficult.*

I have retained the name of gluten for the nitrogenous matters insoluble in water, although these matters are not gluten properly so called, this latter substance always containing a certain quantity of oil without which it cannot be isolated from the farina. It will be understood, moreover, that I have subtracted from the total weight of the nitrogenous matter, furnished by the estimation of the nitrogen under the form of ammonia, the weight of the soluble nitrogenous matter, or vegetable albumen, which I estimated, from the mean of several analyses of the soluble portion of corn, at one-fifth of the weight of that portion.

By uniting the gluten and the vegetable albumen, that is to say, the mixture of the different nitrogenous matters which exist in corn, I found, as already shown by experiments anterior to mine, that their proportion varies considerably in different kinds of wheat, sometimes from simple to double. Thus, whilst the white *touzel* of Provence yielded 9·8 per cent. of nitrogenous matters, an Egyptian corn, grown by M. Vilmorin, at Verrières, contained 20·6 per cent. of these matters.

I have also been enabled to prove, by the examination of two well authenticated samples of corn, the variations of composition which atmospheric circumstances may cause the same kind of corn, cultivated in the same soil, and manured as similarly as possible, to undergo. M. L. Vilmorin sent me a sample of conical blue pollard wheat, gathered at Verrières in 1844, after a season of average dryness; it contained 15·3 per cent. of nitrogenous matters. The same corn, gathered in 1846, in a very dry season, contained 18·1 per cent. of these matters.

Although these grains belong to the species regarded as demi-hard, they gave much more considerable quantities of nitrogenous matters than other hard grains; so that, in my opinion, the difference considered to exist between soft and hard corn, with respect to chemical composition, is not based on any very solid foundation. We have seen that the fatty matters are found in nearly the same proportions in each. It is the same as regards the nitrogenous matters, according to my analyses; thus, the Polish Odessa and the *mitadin* of the South furnished more nitrogen than wheat of Tangarock. I do not mean to say that there exists absolutely no difference, in composition, between the softest and the hardest grains; but this difference vanishes when the latter is compared with demi-hard corn. I think that, at all events, it must be sought rather in the anatomical structure of the grain than in its chemical composition.

The following is the proportion of nitrogenous matters, soluble and insoluble, yielded by the samples of corn which I analysed, in 100 parts:—

	Gluten and albumen.
White touzel of Provence.....	9·8
Spanish wheat.....	10·5
Red Pollard.....	10·6
White Flemish wheat.....	10·7
Hedge hog wheat.....	11·6
Hardy white.....	12·5
Tender *Banat*.....	13·4
Tangarock.....	13·6
Polish Odessa.....	14·3
Conical blue pollard (average year)	15·3
Mitadin of the South.....	16·0
Conical blue pollard (very dry year)	18·1
Egyptian wheat.....	20·6
Polish wheat.....	21·5

In comparing my analyses, as regards the proportion of nitrogenous matter, with the analyses of wheat farinas executed by M. Boussingault, it will be remarked that the quantities of gluten and albumen furnished by these farinas are much more considerable than I have found in corn. Indeed, whilst, according to my analyses, corn would con-

* Since preparing this memoir, I have learnt from Dr. Hofmann that my process of estimating nitrogen is generally employed in England for testing manures.

tain on the average 14·4 per cent. of nitrogenous substances, the farinas analysed by M. Boussingault contained, on the average, no less than 21·8 per cent. of these same substances. These considerable differences are owing to two causes: in the first place, M. Boussingault analysed farinas, that is to say, wheat deprived of its cellulose and of a portion of its fatty matter, for the latter remains in greater quantity in bran than in farina: then he remarks that "all the corns whose farinas were submitted to analysis were cultivated on a rich soil, a circumstance which exerts the most direct influence on the augmentation of gluten in wheat." The samples of corn which I analysed were, on the contrary, taken by chance among the kinds most common in commerce.

I have sought to account for the differences which the determination of the nitrogenous matters of corn presents, according as it is made by means of the process which I followed, that is to say, the estimation of the nitrogen, or else by weighing the gluten obtained by malaxating farina in a stream of water. This latter process, which was first employed, in 1742, by Beccari, a physician of Bologna, to whom the discovery of gluten is due, and which Vanquelin followed in his analyses of farinas, furnishes, when employed in good conditions, results which differ very little from those obtained by more perfect methods. It appeared to me interesting to determine these conditions: it is known that it is necessary to operate on from 25 to 100 grammes of farina to extract the largest proportion of gluten; when we operate well, we obtain proportionally so much the more as we employ more farina. Besides, the farina put in contact with the water must not have been kept in too dry a place; when it has been dried by means of a fire, the preparation of gluten becomes difficult, and the quantity extracted is considerably less than that which is furnished by undried farina. I dried at 250° F., 100 grammes of farina, and I made it into a paste, following the ordinary precautions for extracting gluten. This paste was short and broke into small pieces, whilst that which was made with 100 grammes of the same farina undried was tenacious: it was necessary to keep it twelve or fifteen hours to render it elastic and to extract the gluten, which, besides, had become very elastic. It furnished 7·5 per cent. of dry gluten, whilst the same farina undried gave 9 per cent. of that substance, which was obtained in one hour after the farina had been mixed with water.

Another experiment unveiled to me the influence which the fatty matter of farina exerts on the preparation of gluten, and, consequently, doubtless, on the preparation of bread. From 2 to 300 grammes of wheat farina, whose good quality had been proved by extracting the gluten which it contained, was treated with sulphuric ether. A portion of this farina, thus deprived of its fatty matter, was dried in the air, then at a gentle temperature, and finally was left in the air for a few days. The paste which was made by mixing it with water was first kept for an hour in a warm place; but, as it did not become tenacious, the extraction of the gluten was left until next day. Notwithstanding these precautions, this paste, malaxated in a stream of water with the customary care, did not leave in the hand of the operator the smallest quantity of gluten: the whole mass was diluted under the form of a soapy emulsion, in which the nitrogenous matter remained intimately mixed with the starch.

An experiment of another nature was made with the view of investigating whether the small quantity of fatty matter which is found in the farina is sufficient for retaining in the plastic state all the gluten found in it; for I doubt not, from the experiment which I have just detailed, that this matter remains altogether with the insoluble nitrogenous matter, to which it serves, so to speak, as a cement. To 100 grammes of ordinary farina, a sample of which had given 9 per cent. of dry gluten, were added 4 grammes of fatty matters extracted from the farina itself. The mixture was long and difficult to effect; then this farina, which contained about 5 per cent. of fatty matters, treated by water, furnished a paste which beating for a long time did not render tenacious. This paste, kept for several hours, gave gluten; but it was necessary to operate with much care, for it was divided in water, and the gluten fell in pieces: the pieces could not be united. This gluten was not elastic. The 100 grms. of farina gave 8·9 grs. of this gluten in the dry state, consequently a smaller quantity, notwithstanding the excess of fatty matter, than was furnished by the same farina not mixed with fatty matter.

Thus, the fatty matter which nature has deposited in the corn is in such accurate proportion, that it is not possible to change it without modifying the most valuable properties of this cereal. This is a point to which I shall have occasion to recur hereafter, in studying the composition of wheat bran.

STARCH.

To complete the analysis of corn, as regards its principal constituent elements, it remains for me to speak of the estimation

of the starch and cellulose contained in corn. As regards the mineral salts, which I determined by the incineration of a great number of samples of corn, I proved that their weight varies between 1·5 and 2 per cent. The analysis of these salts presents numerous difficulties, which I propose soon to lay before the Academy.

The accurate determination of starch is an operation full of difficulties. Vanquelin's process, which consists in collecting and weighing, after dessication, the starch which remains after the separation of the gluten, cannot be employed for corn, for the starch would be mixed with the bran. Imperfect as it is, I still think it preferable to every other known process, when it is required to analyse farinas, although it is proved that starch remains in the gluten and gluten in the starch. I think it is especially superior to the method employed by Krocker, who has recently been occupied with the determination of the starch contained in a certain number of aliments. Mr. Krocker converted starch into sugar by means of boiling, in presence of a small quantity of sulphuric acid; then he transformed the sugar into alcohol and carbonic acid by means of beer yeast. It was by collecting this carbonic acid with suitably disposed apparatus, that he deduced, from the weight of this acid, the proportion of starch contained in the substances which he analysed.

This process presents the inconvenience of converting into sugar not only the starch, but also the dextrine contained in different grains, especially in corn; so that the carbonic acid produced by the saccharification of dextrine renders the estimation of starch too high. However, the numbers given by Krocker seem to indicate a smaller proportion of starch than ordinarily exists in corn; which arises, doubtless, from the well known uncertainties which the process of fermentation applied to the estimation of sugar presents. M. Biot's process would assuredly be much more accurate and more rapid.

I have sought to determine the starch contained in corn by two methods: 1, by converting into sugar, by means of very dilute sulphuric acid, the starch contained in corn, the latter being previously freed from the fatty matters and matters soluble in water which it contains, and weighing the residue, which consists of insoluble nitrogenous matters and cellulose. 2, by effecting the same transformation by means of diastase, and weighing likewise that which remains after the action of this substance has continued for a long time. In either case, the action was continued until the residue ceased to give a blue color with the aqueous solution of iodine. In order to effect the saccharification of starch by means of sulphuric acid, we add to the water which holds in suspension corn washed and deprived of its fatty matter only a few drops of sulphuric acid, then a current of steam is passed into the liquor. If we take care to stop the operation as soon as the starch has disappeared, the result obtained by weighing the residue, washed and dried at 230° F., is accurate; for the weight of the starch which is furnished by the loss which the corn has undergone, added to the weight of the other substances which have all been separately estimated, represents very nearly the total weight of the matter employed. But if the action of the sulphuric acid be continued too long, a small quantity of nitrogenous matter becomes soluble, and, consequently the estimation of the starch is too high by some hundredths.

The process of estimation by diastase, which is pointed out by many authors as furnishing good results, presents the contrary inconvenience. It consists in putting starch washed with water, freed from fatty matter, and already thickened by contact with warm water, in digestion with an infusion of germinated barley, and prolonging the contact, at the temperature of 122 to 140° F., until the liquor does not turn blue by iodine. It sometimes requires several days to arrive at this result, although I have proved that a solution of starch powerfully colored by iodine is immediately decolored when mixed with the tepid infusion of germinated barley; but, as the temperature is not very high, the matter is slowly disaggregated, and even then, do what we will, there always remains a certain quantity of grains of starch which the diastase does not attack, and which are found imprisoned in the insoluble residue, even when iodine no longer detects the presence of starch. Also the weight of this residue being much higher than it should be, the proportion of starch, represented by the difference, is found to be too small.

I may, moreover, remark that, having determined all the other elements of corn, I may calculate, by the difference, the proportion of starch. But I should have preferred having at my disposal a process which would have enabled me to make this estimation with accuracy. Such a process remains to be discovered; I think that by converting into glucose, by means of sulphuric acid, the starch of well-washed farina, and by estimating the sugar produced by means of M. Biot's polarisation apparatus, we might arrive at better results than by any other process known, provided that the nitrogenous matter rendered soluble would exert no action on polarised light.

Be it as it may, the numbers which I obtained by the conversion of starch into glucose differ only a few hundredths from those which are deduced by calculation, that is to say, by the quantity which it was necessary to add to the principles of corn which I estimated directly, in order to complete the weight of the matter employed. I have, therefore, reason to consider them accurate. They tend to prove that the average quantity of starch contained in wheat does not exceed 64 per cent. This result, which agrees with that which M. Boussingault deduced from an analysis of wheat which gave him 63·2 of starch, differs from that which was obtained by Mr. Krocker, who estimated at only 56, 52, and 53 per cent. the quantity of starch contained in three samples of wheat which he studied. It differs still further, in the opposite direction, from the numbers obtained by M. Rossignon, published in M. de Gasparin's learned work. M. Rossignon found, indeed, in the 25 samples of wheat which he analysed, quantities of starch and cellulose varying between 78 and 87·5 per cent; the mean of these analyses gives 81·4 per cent. for these two substances. I do not know in what manner these results were obtained; but, whatever may be the part assigned to cellulose, these results are impossible; for, in taking account of the weight of the nitrogenous matters determined by M. Rossignon, they lead to this conclusion, that wheat would be composed of nitrogenous matters, starch, cellulose and 1 hundredth at most of dextrine, sugar and mineral matters. I am also enabled to affirm that these results have led M. de Gasparin into error, when that illustrious agricultural writer says, after having quoted them:

"Thus the quantity of nitrogenous matter may descend from 20·5 to 12, and the complement of this cypher gives nearly the starch, for it is evident that the mass of other compounds is almost inappreciable." There exists in corn, under the forms of water, fatty matters, dextrine and mineral salts, at least 25 per cent. of substances which M. Rossignon omitted to mention.*

(To be concluded in our next.)

* In deducing from M. Rossignon's analyses the composition of corn, the following numbers are obtained:—

Nitrogenous matters.....	16·4
Starch and cellulose	81·4
Dextrine	0·3
Sugar	0·7
Fatty matter	0·1
Salts	0·1
Loss	1·0
	100·0

CHEMICAL INVESTIGATIONS ON THE EGGS OF THE CARP.*

BY M. GOBLEY.

Are the various compounds which are met with in living bodies formed at once by a creative force whose action escapes us? Are they, on the contrary, previously deposited or derived from external sources, or do they only undergo transformations whose series we are enabled to follow? These questions are represented throughout physiology and organic chemistry, and I need not expatiate on their importance and interest. To arrive at their solution, it was evidently necessary, as in studying the transformation of the tissues in physiology, to take the animal in its most simple state, and follow it by successive analyses to its most advanced development. These studies, which present in viviparous animals almost insurmountable difficulties, are more easy in birds and fishes, and we can follow the chemical modifications which are produced in the animal left to itself and isolated from all chemical influence except that of the air. It was in these kinds that I found the first elements of the works which I propose to submit to the Academy.

What are the chemical elements of the eggs of birds and fishes? Are these elements the same? In what part of these animals are they afterwards found, and consequently what would appear to be their physiological importance? Such are the thoughts which guided me in my studies; I do not pretend to have completed them; I only wished to commence investigations which might afterwards lead to results which it is not given to a single observer to obtain.

In the researches which I have already presented to the Academy of Sciences, I sought to establish the chemical composition of the yolk of fowls' eggs; in those which I have the honor of making known to-day, I propose to study that of fishes' eggs. Birds and fishes live in entirely different media; it appeared to me interesting to examine if any identity exists between the chemical elements constituting the eggs of these two classes of animals.

The eggs of fish have been the subject of only very few chemical investigations.

In the tables of the analyses of animal

* The Academy of Medicine, on the report of a committee composed of M M. Guibourt, Chevallier, and H. Gaultier de Claubry (reporter), gave its approbation to this Memoir. *Bulletin de l'Academie de Medicine*, t. xv. p. 471.

substances by John, we find no analysis of these bodies. Vauquelin appears to have been the first who studied the eggs of fish: his experiments which were made on the eggs of the pike, and which he published in 1817,* led him to consider them as containing: 1, much albumen; 2, an oily matter; 3, an animal substance having some relation to gelatine; 4, muriates of potassa, soda, and ammonia; 5, phosphates of potassa, lime and magnesia; 6, sulphate of potassa; 7, phosphorus.

M. Morin, pharmacien at Rouen, undertook in 1823 the analysis of the eggs of the trout (*Salmo Fario*, Linn.) and of those of the carp (*Cyprinus Carpio*, Linn.). The results of this work † differ little from those obtained by Vauquelin; the eggs of trout and carp presented him with the same principles as those of the pike.

In 1827, M. Dulong of Astafort subjected to analysis the eggs of the common barbel (*Cyprinus barbus*, Linn.), which furnished him the same principles as Vauquelin and Morin found, the former in the eggs of the pike, and the latter in those of the trout and carp:‡ 1, albumen; 2, oily matter; 3, matter soluble in alcohol, analogous to osmazome; 4, a substance insoluble in alcohol, somewhat resembling gelatine; 5, phosphorus; 6, hydrochlorates of potassa, soda and ammonia; 7, phosphates of lime and potassa; 8, an organic salt of potassa.

Although these analyses afford only an imperfect knowledge of the composition of the eggs of fish, we may draw from them this conclusion, that they possess essentially the same composition in all species. It appeared to me, therefore, a matter of indifference as to the eggs of what particular fish I operated on. I selected for my experiments the eggs of the carp, because they were most easily procured.

These eggs appear to have only a mucilaginous envelope; they are surrounded by a very small quantity of a liquid which has no alkaline reaction on reddened litmus paper, and which contains albumen, for if it be separated by carefully agitating the eggs in distilled water, it coagulates when exposed to the temperature of about 160° F., which is a certain indication of the presence of albuminous matter.

The eggs of the carp appear to be wanting in true albumen, that is to say, an alkaline albumen like that of fowls' eggs. This fact is so much the more curious, as MM. Baudrimont and Martin Saint-Ange seem to have proved the same thing as regards the eggs of *batracians*, which establishes a certain analogy between the eggs of two classes of animals which resemble each other in so many respects.

In order to render the explanation of facts more easy, I will commence by giving the composition of the eggs of the carp; I will afterwards describe the properties of their constituents.

The bodies which I have extracted from the eggs of fishes are:—

1. Water;
2. Albuminous matter or paravitelline;
3. Cholesterine;
4. Lecithine;
5. Cerebrine;
6. Oleïne and Margarine;
7. Salts: such as chlorides of sodium and potassium, hydrochlorate of ammonia, phosphate of potassa, sulphate of potassa, phosphates of lime and magnesia;
8. Extract of meat and an organic acid which is probably lactic acid;
9. A coloring matter;
10. An odorous principle.

I found sulphur only in the albuminous matter; I was unable to detect in the eggs of carp the presence of volatile fatty acids. I was also unable to prove the presence of gelatine; that which I found resulted from the boiling in water of the envelope of the eggs and of the membranes to which they are attached.

The estimations of the constituent principles of the eggs of carp were made for the most part in the month of May, the period at which they are most fully developed.

WATER.

To determine the quantity of water contained in the eggs of the carp, I separated them from the membranes which enveloped them, and dried them with a fine cloth to free them from the albuminous liquid. I then dried them on the sand-bath; I kept them exposed to the action of heat, taking care to move them continually, until they lost no more in weight. The mean quantity of water lost by 100 parts of the eggs of the carp is 64·080.

ALBUMINOUS MATTER OR PARAVITELLINE.

Vauquelin, Dulong of Astafort, and Morin of Rouen, noticed in the eggs of fish the presence of an albuminous matter. Indeed, if the eggs of the carp be triturated with distilled water, it is easily ascertained, by heating the liquor after having filtered it, that it contains a substance analogous to albumen, for it assumes the form of a mass as soon as the temperature reaches 150° F.

After having proved the presence of an

* *Journal de Pharmacie*, t. iii.
† *Ibid*, t. ix.
‡ *Ibid*, t. xiii.

albuminous matter in the eggs of the carp, a difficulty presented itself in the estimation of this body. In the fowls' egg, it was sufficient, to arrive at it, to dry the residue which boiling alcohol leaves after it has been made to act on the yolk of egg, deprived, by exposure to the open air, of the greater part of the water which it contains: this process could not be employed for the eggs of the carp, for they are accompanied by membranes and envelopes from which it is impossible to free them. I was enabled to separate the albuminous matter by triturating the eggs a great number of times with distilled water, straining each time with powerful pressure and filtering the liquid through paper; the liquid was then heated, and the coagulated albumen received on a filter, and again dissolved in boiling alcohol, at two different times; finally, it was dried in an oven, and, as it still retained a certain quantity of fatty matter, it was finely powdered and put in contact at first with rectified ether, and then with boiling alcohol at 40°, which was renewed until nothing more was dissolved.

By this process, 200 grammes of the eggs gave 33·400 grs. of albuminous matter, which lost 5·037 grs. by dessication at the temperature of 230° to 250° F., which gave 28·263. In a second experiment, 200 grs. of the same substance furnished 28·560 of albuminous matter. The mean of the quantity of the substance contained in 100 parts of the eggs of carp is, therefore, 14·230; if we deduct the 0·170 gr. of saline residue which the 14·230 (0·585 gr. leave 0·007 gr.) leave by incineration, we obtain as the real quantity of albuminous matter 14·060 per cent. These ashes contain traces of iron.

When the eggs of carp, sufficiently divided, are dissolved in boiling alcohol, all the fatty matter is dissolved, and the residue is formed of the coagulated albuminous matter, of the membranes which keep the eggs united, and of the envelopes of these eggs; this residue weighed as a mean 28·760 per cent. If we now deduct from this number the 14·230 of albuminous matter contained, as we have just shown, in 100 parts of the eggs, we have 14·530 for the membranes and the envelopes.

The albuminous matter of the eggs of the carp, obtained as I have just described, presents a light reddish tint; it possesses, moreover, the properties of that of yolk of egg; it dissolves in hydrochloric acid, communicating to it a beautiful blue color; it contains sulphur and phosphorus; 3·032 grs. of albuminous matter gave 0·200 gr. of sulphate of baryta and 0·080 gr. of phosphate of the same base, which corresponds to 0·99 per cent. of sulphur, and 0·37 per cent. of phosphorus.

It was interesting to prove if the albuminous matter of fishes' eggs possesses the same composition as that of the yolk of the fowls' egg. The following are the results which I obtained.

1. 0·585 gr. of crude matter, prepared as I have just stated, left 0·007 of ash, or 1·196 per cent.

2. 0·454 gr. of the same substance gave 0·866 gr. of carbonic acid and 0.304 gr. of water.

3. 0·380 gr. of the same matter gave 48 cubic centimetres of nitrogen at 59° F., the humid gas, which gave, in hundredths :—

Carbon.....	51·601
Hydrogen.....	7.745
Nitrogen.....	15·151
Oxygen, sulphur, &c....	25·503
	100·000

These numbers perceptibly agree with those which I indicated for the albuminous matter of the egg of the fowl, which also agree with those which MM. Dumas and Cahours obtained for the same substance.

Thus, the albuminous matter of the yolk of egg and that of the eggs of the carp appear to be identical; therefore, I propose to designate the latter under the name of Paravitelline.

Albuminous matters are, doubtless, one of the principal means which nature employs for holding the earthy phosphates in suspension in animal liquids and for conveying them into the different organs of the animal economy.

CHOLESTERINE.

When the yolk of the fowls' egg is treated by ether or by boiling alcohol, all the fatty matter is separated from it: it is formed of two perfectly distinct parts, a fixed oil and a soft substance, of viscid consistence. If the oil be afterwards treated by boiling alcohol, we obtain, by the cooling of the alcoholic liquid, crystallised cholesterine, and by repeating the treatment a great number of times, all the cholesterine is removed, and a fatty matter consisting only of oleïne and margarine is left.

When the eggs of fish are treated in the same manner, the liquid which is obtained leaves only, by evaporation, a soft, viscid substance, of a reddish-yellow color; we do not find in the products of the operation an appreciable quantity of fixed fatty body. The eggs of the carp differ, therefore, in this respect, from fowls' eggs; this is an important fact which I consider worthy of the attention of physiologists.

Owing to the absence of fixed oil in the

eggs of the carp, it was very difficult to ascertain if they contained cholesterine; for, by treating by boiling alcohol the product obtained by means of ether, no substance crystallised by the cooling of the liquid. I, however, regarded it as very important, to ascertain if this body which I had met with in the fowls' egg existed in fishes' eggs, more especially as it seems to perform an important part in our animal organisation, since it is met with in the principal organs and liquids of the economy, in the brain, the lungs, the liver, blood, bile, &c. &c.

The following are the means of proving the existence of cholesterine in the eggs of fish. Eggs of the carp were triturated with several times their weight of distilled water, and the whole boiled and strained with powerful pressure. This operation is repeated a second and third time; the residue was dried and exhausted by ether; the latter gave by evaporation a fatty matter which, dissolved in boiling alcohol and left to itself, furnished viscid matter which was deposited on the bottom of the capsule, and a liquid which contained a large quantity of crystallised cholesterine.

By dissolving in boiling alcohol the substance left after the separation of the cholesterine, a further quantity may be obtained.

I was enabled, by this means, to procure cholesterine in sufficient quantity for examination; I was also enabled by operating carefully to estimate it very accurately.

The lamellæ of cholesterine obtained as I have just described, are not pure cholesterine; it is necessary to boil them in alcohol rendered alkaline by a small quantity of potassa, and crystallise them several times, each time taking care to wash the crystals several times with cold alcohol on the filter.

The cholesterine may also be obtained by acting with boiling alcohol on olive oil put in contact with the fatty matter of the eggs of the carp. When the latter is heated with a fixed oil, the cholesterine and coloring matter are dissolved, so that the filtered liquid possesses the composition of the oil of the egg. We shall revert to this reaction in speaking of the coloring matter of the eggs of the carp.

The mean quantity of cholesterine which I obtained from 100 parts of the eggs of the carp, was about 0·296.

The cholesterine of fishes' eggs possesses the physical and chemical properties of that of the yolk of the fowls' egg and of biliary calculi; it has also the same composition, for, submitted to analysis, 0·410 gr. of this substance, fused, and, therefore, free from water, furnished 1·279 gr. of carbonic acid, and 0·430 of water, which gives, in hundredths:—

Carbon	85·075
Hydrogen	11·652
Oxygen	3 273
	100·000

To be continued.

ON THE ACTION OF CHLORIDE OF CYANOGEN ON TOLUIDINE.*

BY W. WILSON, ESQ.

THE perfect homology existing between toluidine and aniline left but little doubt respecting the deportment which the former alkaloïd would exhibit, when exposed to the influence of chloride of cyanogen; still the discrepancies which we frequently observe between the various members of one series, especially if we rise on the scale of compounds, made it desirable to establish the behavior of toluidine by experiment.

PREPARATION OF TOLUIDINE.

The preparation of toluidine is a process of considerable difficulty, inasmuch as the collateral hydrocarbon can be obtained only in comparatively small quantities. The formation of toluol has hitherto been observed in different processes, namely: in the distillation of tolu-balsam by Deville, its discoverer; in the distillation of dragon's-blood (dracyl) by Boudault and Glenard; in the decomposition of toluylic acid by Noad; and, lastly, it has been met with among the hydrocarbons of coal-tar naphtha by Mansfield.

I have tried all these methods in order to procure toluol in larger quantities, and I find that the source last mentioned is that which yields this compound most easily and in greatest quantity;—only comparatively minute quantities being obtained by the other processes.

The best plan is to select the fraction distilling between 212° and 248° F., and to treat this portion with half its bulk of concentrated sulphuric acid. I am not prepared to say what substances are removed by this process; the fact is, however, that a constant boiling-point is more easily reached with, than without, the use of sulphuric acid. In all cases, a series of tedious distillations is required, in order to accomplish this object. The boiling-point of toluol was found to be 230° F.

* *Quarterly Journal of the Chemical Society*, July 1, 1850.

The conversion of toluol into nitro-toluol succeeds without difficulty in the usual manner. Nitro-toluol was found to boil between 428° and 437° F., without decomposition.

Those chemists who have used Zinin's process for the amidation of nitro-compounds, are aware how difficult it is to effect the complete conversion of those substances when treated with sulphide of ammonium, especially if there is but one equivalent of hyponitric acid present. I have used in my experiments a solution of hydrosulphate of sulphide of potassium, with which the nitro-toluol was repeatedly distilled. The advantages which the potassium compound presents are very remarkable, not half the time being required as with sulphide of ammonium; moreover, the base, once formed, has no longer to be separated from the ammonia, which, in the latter case, distils over with it.

The toluidine obtained in this manner, after having been several times crystallised, in the form of oxalate, and, lastly, distilled with caustic lime, presents all the properties which its discoverers assigned to it.

PREPARATION AND ANALYSIS OF METOLUIDINE.

In subjecting toluidine to the action of chloride of cyanogen, I adopted, in the first place, the same arrangement that Dr. Hofmann had used in preparing melaniline, namely, by a series of tubes, filled with the *dry* alkaloïd, through which the chloride of cyanogen was drawn by means of an aspiration. I soon found, however, that the deportment of toluidine is by no means so simple as that of aniline under similar circumstances. The alkaloïd being solid at ordinary temperatures, it was necessary to support the action from the very commencement by the application of heat, under the influence of which, unless it be very carefully applied, the newly formed hydrochlorate appears to undergo some further metamorphoses. On this account I found it more convenient to introduce toluidine into a slightly bent tube, to diffuse it by a gentle heat into a thin layer over the sides, and then to expose this increased surface to the action of the gas. In this manner, the heat evolved during the reaction was sufficient to keep the substance in a state of fusion. As soon as the action had ceased, the resinous mass, consisting almost entirely of hydrochlorate of the new base, was dissolved in water to which a small quantity of hydrochloric acid had been added. On mixing the filtered solution with potassa, a white precipitate was formed, which was boiled for some time with the potassa, in order to distil off with the aqueous vapors small quantities of toluidine which might have escaped the action. The residue was thrown upon a filter, separated by washing from the chloride of potassium, and recrystallised from alcohol.

From this solution, the new base, which I propose to call *Metoluidine*, a name corresponding to melaniline, is deposited in small crystalline plates. It crystallises better from a mixture of alcohol and water, but by no means with the same facility as melaniline; this substance is but slightly soluble in water, but somewhat more so at the boiling temperature.

I have established the composition of metoluidine by analyses of the base itself, and by that of the platinum salt:—

0·2201 grm. of base gave
0·6048 „ of carbon and
0.1454 „ of water.

These numbers, together with those obtained with the platinum salt, lead to the formula

$$C^{30}H^{17}N^{3},$$

which requires the following values:—

	Theory.		Experiment.
30 eq. of Carbon....	180	75 31	74·54
17 „ „ Hydrogen.	17	7·11	7·34
3 „ „ Nitrogen...	42	17·58	—
	239	100·00	

METOLUIDINE AND BICHLORIDE OF PLATINUM.

Metoluidine is readily soluble in hydrochloric acid. The solution yields, with bichloride of platinum, a dark yellow precipitate, which is insoluble in water and alcohol, and may be dried at 212° F.

On analysis, the following numbers were obtained:—

I. 0·2686 grm. of platinam salt gave:
0·3980 „ „ carbonic acid, and
0·1025 „ „ water.
II. 0·1397 „ „ platinum salt gave:
0·0418 „ „ platinum.
III. 0·2985 „ „ platinum salt gave:
0·0659 „ „ platinum.
IV. 0·1096 „ „ platinum salt gave:
0 0244 „ „ platinum.

These numbers lead to the following per centage composition:—

	I.	II.	III.	IV.
Carbon..	40·40	—	—	—
Hydrogen	4·04	—	—	—
Platinum	—	22·03	22·07	22·26

The formula

$$C^{30}H^{17}N^{3}HCl\,PtCl^{2}$$

requires the following values :—

	Theory.		Experiment.
30 eqs. of Carbon ..	180·00	40·43	40·40
18 „ „ Hydrogen	18·00	4·04	4.24
3 „ „ Nitrogen.	42.00	9 43	—
3 „ „ Chlorine.	106·50	20·93	—
1 eq. „ Platinum	98·68	22·17	22·15
1 eq. Platinum salt.	445·18	100·00	

The formation of metoluidine is perfectly analogous to that of melaniline; 2 equivalents of toluidine, and 1 equivalent of chloride of cyanogen, yield 1 equivalent of hydrochlorate of metoluidine.

Toluidine. Chloride of Cyanogen. Hydrochlorate of Metoluidine.*

$$2\,C^{14}H^{9}N + C^{2}NCl = C^{30}H^{17}N^{3}, HCl.$$

NEW EXPERIMENTAL RESEARCHES ON THE EMPLOYMENT OF PURE NITRIC ACID, CONJOINTLY WITH STARCH PASTE, FOR DETECTING THE PRESENCE OF IODINE IN A MINERAL WATER.†

BY M. CASASECA.

THE author, in concluding his memoir, presents, in the following terms, the results at which he has arrived :—

We think that we may conclude from these investigations :—

1. That even the purest sulphuric ether cannot be employed as a solvent of iodide of potassium :

2. That that of commerce, containing alcohol and water, cannot be employed for detecting iodine in the mixture of iodide with a sulphuret, an alkaline sulphite and hyposulphite, because, then dissolving these salts, the final demonstration is wanting, since they are opposed to the formation of the blue iodide of starch.

3. That if we have heretofore succeeded with sulphuric ether imported from France to Havana, it is because it contained acetic ether.

4. That the acetic ether of commerce may be employed with wonderful success, and substituted for sulphuric ether, by applying it in the same manner as we directed for the latter in our first memoir, with the exception of the previous treatment by sulphuric acid, which becomes useless, and which may serve very well directly for dissolving the iodide and aid in detecting the iodine in a mineral water in which the iodide exists in the state of mixture with chlorides, bromides, sulphites, sulphurets and hyposulphites, even when there is only a hundredthousandth of iodide present and a thousand times its weight of each of the other salts; for it furnishes, as a final result, a residue which, dissolved in water, gives a magnificent blue-violet iodide of starch, with the paste and pure nitric acid.

5. That, by the sole intervention of sulphuric acid in excess, by boiling the liquor for a quarter of an hour, and without having recourse to acetic ether, when there is a great excess of sulphurous salts, or by the previous addition of 5 decigrammes of sulphite of soda to 1 decilitre of the water to be tested, when there is very little of it, we are readily enabled to detect 0·000002 gr. of iodide in the state of mixture in a mineral water, even in the most complicated cases.

6. That the treatment by acetic ether in a steam-bath, for five minutes, of the residue of the evaporation to complete dryness of a saline water containing an enormous quantity of alkaline bromide, constitutes a new and very powerful means of eliminating this salt, which is much more simple, much more commodious and expeditious than that which consists in the alternate employment of chlorine and sulphuric ether, which we indicated in another memoir.

7. That, thanks to the new and second means of eliminating an alkaline bromide, we shall not have in future to fear the presence of bromine in the detection of iodine, and that, consequently, in future, the presence of an alkaline bromide will not prevent us from detecting iodine in sea water.

8. That, of all the reagents hitherto known and proposed, pure nitric acid, employed conjointly with the paste of starch, either alone, or preceded in its employment by the intervention of acetic ether with heat, or of sulphuric acid at 66° Beaumè, according to circumstances, seems to be the most delicate, the most convenient and the most economical.

9. That the introduction of this new reagent into the practice of chemical researches will singularly aid in the detection of iodine, especially when it exists in the state of iodide.

* The bases produced by the action of chloride of cyanogen upon aniline and toluidine exhibit a remarkable analogy with one of the platinum alkaloïds obtained by M. Reiset, which will at once become perceptible if we compare the formula of the chlorides, when considered as ammonia compounds :—

Chloride of Reiset's base, $\left\{ \begin{matrix} H^{2} \\ Pt \end{matrix} \right\} N^{3}H^{4}NCl$

Melaniline, $\left\{ \begin{matrix} H \\ C^{12}H^{5} \\ Cy \end{matrix} \right\} N \left\{ \begin{matrix} H^{3} \\ C^{12}H^{5} \end{matrix} \right\} NCl.$

† *Comptes Rendus*, No. 25, June 24, 1850.

THE BORACIC ACID LAKES OF TUSCANY.*

THE Tuscan Lakes are, properly speaking, natural depressions of the soil ordinarily filled with water, from which hot vapors are ejected. They are situated within a space of ten or twelve miles, lying between 28° 27′ and 28° 40′ of longitude, and 43° 10′ and 43° 15′ of latitude. The principal lakes are those of Monte Cerboli, of Castel Nuovo in the valley of Cecina, those of Sasso, of Monte Rotondo, of the Lago del Edifizio, of Lustignano and of Serrazzano in the valley of Cornia. The ancients were acquainted with the Tuscan lakes, and the name of Mount Cerberus accords well with the poetical and mythological ideas of the early people of Italy.

Even so late as the 18th century the lakes were regarded only as a supernatural wonder which excited astonishment rather than courted investigation. Under the Grand Duke Leopold I., the chemist Hœfer discovered by analysis, that they contained boracic acid. This discovery, followed by further explorations, has bestowed on the lakes an unrivalled industrial importance, and has brought into the countries possessing them an activity contrasted strikingly with the miserable state in which they before languished. It is a curious fact in their history that before the discovery of this acid, the fetid odor developed by the sulphuretted hydrogen gas, —the certain death which met the man who fell into the scalding baths,—the disruptions of the ground occasioned by the appearance of new *Soffioni*,—and above all the superstitious terror with regard to them, had made the people consider the lakes as a scourge, from which they sought deliverance by public prayers; but now, if by any cause the *Fumacchi*, the source of common prosperity, should become extinguished, they would not fail to seek from Heaven a restoration of this scourge, which in the skilful hands of M. Larderel, has become, to quote Dr. Bowring, a source perhaps of greater riches than the mines of Peru or of Mexico, and certainly more to be depended on. After the discovery of Hœfer, Paolo Mascagni, a noted chemist, first conceived the idea of procuring from the lakes boracic acid like that of China, and of thus transferring to Europe the tribute she had paid to Asia. But the attempt was not at first profitable, as the waters contain in solution at the moment of their issue from the earth, only an insignificant quantity of boracic acid. Another chemist having observed that a part of the acid was thrown beyond the lake, by the violence of the vapors, and that it was scattered on the margins of the craters, and moreover, being confident that the waters were capable of dissolving a greater quantity of acid, endeavored to find means of saturating them by constructing on the declivities of the country artificial lakes fed by the streams from the mountain. The vapors which issue from these lakes keep their waters constantly at a boiling temperature. After impregnation for twenty or thirty hours by the vapors of the highest lake, they draw off the waters into the second lake to submit them to a new impregnation. From thence they are drawn into a third, and so on until they reach the receptacle at the lowest point. In their passage across six or eight lakes, they are charged with half per cent. of boracic acid. They are then led into the reservoir, from which they are conducted into leaden reservoirs for evaporation, to produce concentration; and, to hasten that operation, the happy idea was proposed of substituting for the combustibles sometimes used, and which were enormously expensive, the direct application of the heat of the *Soffioni*. This improvement decided the success of the enterprise. It is surprising that it was so lately introduced, since this method was not new, and had been long practised at the *solfatara* of Pozzuoli in extracting alum from the earth that contains it. In the lakes, the hot vapors for carrying on the evaporation are taken at their origin and carried across by leaden pipes or by subterranean conduits below the boilers. Thus the fabrication is extremely simple, the locality itself furnishing the means of carrying it on. A single discharge of the vapors is sufficient to throw into ebullition, almost immediately, 20 or 30 caldrons of a capacity of 20 barrels, which may be estimated at 84,000 pounds of liquid impregnated with boracic acid. Before allowing the vapors to escape, they direct them under the ovens, in order to free the acid from its hygrometric moisture. Of late the somewhat complex system of boilers and coolers has been simplified by substituting rectangular tables of lead of 20 or 30 metres, divided at small intervals by transverse parallel divisions, but whose height is never raised above that of the edges. These tables have an inclination of two or three degrees. The water of the last lake is introduced upon the upper side, in small quantities. The hot vapors for evaporating are conducted in such a manner that they act upon the lower surface.

* *Bulletin de la Société Géologique de France.*

The liquid after having filled the first compartment is diffused very gradually into the second, then into the third, and so successively to the last, when it reaches such a state of concentration that it deposits the crystallised acid; the workmen remove it immediately by means of wooden scrapers. This mode of gradual concentration is very ingenious, and requires so few hands that it may almost be said that the acid is obtained without expense. From 1818 to 1845 the quantity of acid manufactured was 33,349,097 Tuscan pounds. From 1839 to 1845 the mean quantity has been two millions and a-half of pounds.

Thus in estimating the quantity at 7,500 pounds per day, the quantity of saturated water upon which they operate daily is 1,500,000 lbs., and annually 547,500,000 lbs.

This manufacture brings to Tuscany 10 millions of francs, (£400,000), and it is surprising that it should have remained unprofitable during so many ages and that it should have been reserved for the skill of M. Larderel, now Count of Monte Cerboli, and before 1818 a simple wandering merchant, entirely unacquainted with science, to discover the fugitive vapors and render them a source of inexhaustible wealth.

The violence with which the burning vapors escape gives rise to muddy explosions, when a lake has been drained by turning its water into another lake. The mud is then thrown out, as solid matters are ejected from volcanoes, and there forms in the bottom of the lake a crowd of those little cones of eruption whose activity and play exactly recall under another form the *hornitos* of Malpays. Their temperature varies from 248° to 293° F., and the clouds which they form above the lakes constitute true natural barometers, whose greater or less density rarely misleads in the predictions to which they give rise.

While in an industrial point of view the lakes occupy the first rank among the natural products of Tuscany, they place new resources at the disposal of science, permitting the investigation of various geological phenomena, even under the direction of the will of the experimenter. The metamorphic gypsum which we have seen produced at Pereta under the influence of sulphuretted hydrogen vapors, is formed at the lakes, which, like those of Monte Cerboli and of Castel Nuovo, are made to cross argillaceous limestone beds, and with such abundance that their formation may be fully tested. Action also takes place at the same time upon the walls of fractures and the fissures of the soil which open a passage to the subterranean vapors. Thence it extends gradually into the interior of the masses, and it ends by gypsifying whole circles whose radius is generally that of the lakes themselves. Pure limestones are converted into a lamellar sulphate of lime, but of loose texture and free from cellules. This structure is probably due to the expansion they undergo from the addition of new materials, and perhaps also by the passage of the gas at the moment of crystallisation of the salt. The calcareous formations below the argillaceous, preserve after their transformation their primitive position, and they present an alternation of gypseous beds and of argillaceous beds, which the acid has deprived of the soluble bases. When this influence is exerted in the direction of the thickness of the strata, it is very common to see towards the limits where the metamorphic influence ceases, a mass of rock strikingly calcareous at one of its extremities, terminating at the other extremity in a gypsum which the inhabitants use for building. The resemblance to the gypsum beds, occurring in the midst of the secondary formations, is exhibited even in the reddish tint with which oxidation marks the associate clays of the alberèse. But a peculiarity which has given me the solution of a problem which had embarrassed me thus far, deserves mention; for we have reproduced here certain phenomena of which the enormous deposits of the Provençal Alps present many examples. I had noticed at Roquevaire and at Digne, irregular argillaceous incrustations, in which are found entangled without order, angular fragments of sulphate of lime of various sizes. In admitting the transformation of the jurassic limestone of these countries posterior to its consolidation under the influence of the acid vapors, it was difficult to explain the mode of formation of these *breccias* and the manner in which these fragments were introduced. In all these cases they seemed to indicate an overflow of water, but theory opposes the intervention of waters for the accomplishment of the facts relative to the conversion of the limestone, or it leaves in doubt the part which they must have acted. But observe what is apparent at the lakes of Monte Cerboli and of Castel Nuovo. At the same time that the limestone is changed into gypsum, by the contact of sulphurous agents, the fragments of alberèse which waters had brought down from heights above to the midst of the miry and boiling lakes, are thus changed into sulphate of lime, and constitute, with the clays in

which they sink, brecciated argillo-gypsum beds without stratification. That this fact should be equally apparent in the ancient beds under analogous circumstances, is at least what might be inferred from the examination of that which passes at the lakes. We should also observe the analogous positions of the *boracite* of Luneburg, which is found in crystals disseminated in gypsum intercalated in the midst of a cretaceous bed, and the boracic acid and borates of the Tuscan lakes.

These different facts well confirmed, establish, in my opinion, an intimate resemblance between the gypsum of the lakes and the abnormal gypsum beds of secondary regions.

If the silicification of the Macigno which we have noticed in the neighborhood of the solfatara of Pereta should appear an exaggerated application of the theory brought forward, the verification of it may be traced in the lakes of Sasso, where the solution of the silex of the freestone and its re-deposition are manifest in all places where circumstances allow of this double transformation. The Fumacchi of Sasso rise, to the south of the establishments, from beneath a vast mouth of fine-grained freestone, over which passes the mountain-road connecting the valley of the Cornia with the province of Sienna. At intervals the road is interrupted by isolated boiling pools or shallow cavities, which exert a metamorphic action on the regions which they traverse. The first evidence of alteration is apparent in the color of the rock, which from blackish-grey becomes white. It is cracked in all directions. The vapors quickly follow these lines of separation, attack the silica of the macigno, dissolving it out, and immediately depositing it under a gelatinous form. The gelatinous mass becomes opaque in the air and assumes the resin-like appearance peculiar to hydrated silica. In connexion with this we observe imbedded in a siliceous cement, nuclei of a white micaceous sandstone, unaltered at the centre, causing a breccia appearance. This kind of breccia is finally, by the complete solution of the nuclei, converted into an entirely siliceous greyish rock, which resounds under the hammer like clink-stone, and in its aspect and its roughness to the touch exactly resembles porcelain biscuit. Sometimes the solution is more rapid, and then the rock is formed of an agglutination of little grains analogous to those of an ancient quartz rock and possessing its tenacity and hardness. Examined with a glass, each grain is composed of an independent particle or driblet of hydrated silica, and they seem to have collected as viscous tears, such as would have adhered together in hardening. Breislak observed at the solfatara of Pozzuoli fragments of decomposed lava bound together by a siliceous substance almost vitreous; but in the lake of Sasso the solution and permanent regeneration of silica, effected at the expense of the macigno, are carried on upon a vast scale and over a space of great extent.

ON A QUALITATIVE TEST FOR NITRIC ACID.*

BY JAMES HIGGIN, ESQ.

THE methods in ordinary use of detecting nitric acid do not show very small quantities, and the liquid suspected to contain nitrates has generally to be concentrated before the presence of nitric acid can be ascertained.

Being engaged lately in testing for nitrates in water, I employed the following method with perfect success. It is founded on the immediate liberation of iodine from hydriodic acid by nitric acid, and its subsequent detection by starch.

To ensure accuracy, certain minutiæ have to be attended to; and, these observed, the test becomes one of great delicacy.

I. The solution of iodide of potassium must be very dilute, or iodine is liberated by sulphuric acid alone.

II. The solution of iodide of potassium must not be added to the mixture of sulphuric acid and liquid until cold, or iodine is apt to be liberated without the presence of nitric acid.

III. The proportion of sulphuric acid added to the suspected liquid must not be too great, or the most dilute solution of iodide of potassium gives iodine without nitric acid.

IV. As the solution of hydriodic acid formed by the action of sulphuric acid upon iodide of potassium is decomposed by the air in the course of an hour or two, and a blue formed with starch, unless a distinct color is produced in ten to fifteen minutes, it may be concluded that nitric acid is not present.

I dissolve 25 grs. of iodide of potassium in 16 oz. of water for the test solution, which is too dilute to give iodine with sulphuric acid alone.

To the suspected liquid, in a test-tube, I add not more than one-sixth of its bulk of concentrated sulphuric acid; heat nearly to

* *Chemical Gazette*, July 1, 1850.

boiling, and keep hot in the sand-bath for several minutes; cool the tube in cold water, and add a drop of starch-mucilage, and a few drops of the test solution. If nitric acid is present, the liquid assumes a very intense blue color, with even $\frac{1}{500}$th part of nitric acid.

With $\frac{1}{500}$th part by weight of NO^5, intense [dark blue.
" $\frac{1}{1000}$th " " " dark blue.
" $\frac{1}{5000}$th " " " dark blue.
" $\frac{1}{10000}$th " " " paler blue.
" $\frac{1}{15000}$th " " " pale blue.
" $\frac{1}{18000}$th " " " blue tint.
" $\frac{1}{19000}$th " " " blue tinge.
" $\frac{1}{20000}$th " " " faint blue [tinge, becoming de- [cided in a few minutes.

It is remarkable that, even with the great excess of sulphuric acid present, the whole of the nitric acid is not liberated until after heating some time; thus $\frac{1}{16000}$th part required ten minutes' heating before the test would indicate nitric acid; $\frac{1}{18000}$th I heated twenty minutes, and $\frac{1}{20000}$th I found it necessary to heat half an hour before testing.

Probably, by observing the same method, the other tests for nitric acid, viz., proto-sulphate of iron, sulphate of indigo and gold leaf, might become more delicate; but this I have not tried.

Of course some other acids would give the same results, as the chloric and chromic acids, etc., but the absence of these is easily ascertained, and they occur seldom in analyses.

ON THE ATOMIC VOLUMES OF BODIES.*

BY SIGNOR AVOGADRO.

In my first memoir on the atomic volumes, I sought to establish that the atomic volumes of simple bodies in the solid state represented by the weight of their molecules or atoms divided by the density of the bodies, depended on their electro-chemical quality, being so much more considerable as the bodies were more electro-positive or less electro-negative; and that, taking for the molecules of these bodies, or their chemical atoms, as they are generally received, or, for some of them, multiples or very simple submultiples of these atoms.

In afterwards comparing these atomic volumes with the neutralising powers, or acid or alkaline capacities of saturation of all these bodies which I studied in this point of view, by simple chemical considerations, in a memoir published in 1835, and regarding the bodies as forming in this respect a single continued series whose neutrality is only a peculiar point, I found that the chemical volumes of bodies were to each other as the cubes of their *affinitary numbers*, that is to say, of the numbers as expressing their position in this series, or the affinitary numbers as the cubic roots of the atomic volumes. That enabled me to form a table of these very affinitary numbers of different simple bodies, deduced from their atomic volumes, taking, for greater simplicity, for each respectively, the atomic volume and the affinitary number of gold, as one of the best known substances.

In the second and third memoirs, of which I here give an abstract, I have extended these considerations to the compound bodies. I have admitted in them that the affinitary number of a compound body should result, by a simple rule of alloying, from the affinitary numbers of its components, according to the ponderal proportion in which they enter into it, and I determined the divisions into 2, 4, &c., which should be admitted in the compound atom for approximatively satisfying this condition; analogous divisions to those by which, in gaseous combinations, 1 atom of the compound may give, as is known, 2, 4, &c. volumes of gas. But the system of division being once fixed for each compound, we may reciprocally, according to the same principles setting out with the affinitary number of the compound, deduced from its atomic volume given by observation, determine the affinitary number of one of its components, supposing those of the other components to be known. I profited by this circumstance in my two memoirs to obtain, by combination, from equations furnished by different compounds, either among themselves, or with numbers belonging to the simple bodies in the isolated state, different values of affinitary number from the same simple body: by taking the mean, I thus deduced, for each body, determinations which must be regarded as more accurate than those given in the first memoir by the sole consideration of the simple isolated bodies, by a law which can be only approximative. In the second memoir, as regards some of the simple bodies, I made the affinitary numbers immediately deduced from their neutralising powers established in my memoir of 1835, concur in this determination, according to the connection of which I have above spoken, between these powers

* *Memorie dell' Academia delle Scienze di Turin.*

and the affinitary numbers. In the third memoir, I thought it best to entirely separate the result of these two modes of research. I thus determined the affinitary numbers of different simple bodies, according to their atomic volumes, and those of their compounds, in a manner independent of all chemical consideration, and I afterwards deduced the neutralising powers which these same bodies should have, corresponding to these affinitary numbers. By comparing these powers with those which I established for some of these bodies in my memoir of 1835, I have been able to verify the point to which the results of these two modes of determination agree among themselves.

The affinitary numbers which I found in the third memoir by the consideration of the atomic volumes for the different simple bodies, always taking for unity that of gold, presented the following series:—

Oxygen 0·307; fluorine 0·354; chlorine 0·806; bromine 0·825; iodine 0·851; carbon 0·871; boron 0·888; phosphorus 0·950; silver 0·958; palladium 0·959; platinum and iridium 0·962; rhodium 0·969; osmium 0·996; gold 1·000; sulphur 1·029; silicium 1·031; titanium 1·062; manganese 1·065; mercury 1·071; cadmium 1·079; arsenic 1·096; selenium 1·101; copper and nickel 1·109; cobalt 1·117; antimony 1·125; iron 1·129; nitrogen 1·135; tin 1·150; chromium 1·154; bismuth 1·163; molybdenum 1·173; uranium 1·174; tungsten 1·177; lead 1·191; zinc 1·238; aluminium 1·286; calcium 1·292; potassium 1·306; barium 1·355; magnesium 1·359; strontium 1·376; sodium 1·380; hydrogen 3·010.

The numbers of this table differ a little, as might be expected, as regards the substances which I studied in my first memoir, from those which were assigned to them in the table which I formed from the sole consideration of their atomic volumes, taken separately for each of them in the isolated state.

By comparing these numbers with the neutralising powers which I had found for some of the bodies to which they relate, in my memoir of 1835, I was enabled to determine the affinitary number answering to the point of neutrality. This number was found to be 0·878, always taking that of gold as unity; differing little from 0·866 which this same comparison gave in the first memoir, setting out from the affinitary numbers I had arrived at.

I was thus in a position to deduce, by a very simple calculation, from the affinitary number of each of the substances comprised in the above table, the neutralising power acid or basic, which should belong to it, taking for unity the acid or negative power of oxygen.* I thus found for the substances which I studied in the memoir of 1835, numbers differing very little from those which I admitted in that memoir by the chemical considerations therein contained, namely, by designating the acid or acidifying powers by the negative sign, and the basic or alkaline powers by the positive sign, and supposing the neutralising power of oxygen equal to −1, I found, for the power of potassium, + 0·75, instead of +0·67 which the chemical consideration gave me; for chlorine, −0·13, instead of −0·15; for carbon, −0·01 instead of + 0·06; for nitrogen, +0·45 instead of + 0·47; for sulphur, +0·26 instead of +0·22; for hydrogen, 3·7 instead of 3·9. The agreement is, as is evident, as satisfactory as can be expected from two such different modes of determination.

I have in the same way pointed out, in my memoir, the positive or negative neutralising powers which are deduced from the affinitary numbers for the other substances comprised in the above table, and of which I did not give the direct determination in my memoir of 1835; and it is evident that these numbers really thus become the basis of all the chemical relations which exist between different bodies, and perfectly merit the name of affinitary

* The following is the formula for this calculation, deduced from our principles. Let b be the affinitary number of a substance, taking for unity that of gold; its distance from the point of neutrality in the series of these numbers, according to the number which we have found for this latter point, and supposing at first, in order to fix the ideas, that this substance has a number superior to that, and that it should possess, consequently, a positive neutralising power, will be in the same unity $b - 0{\cdot}878$, whilst the distance of oxygen at the same point, according to the affinitary number of oxygen, will be $0{\cdot}878 - 0{\cdot}307 = 0{\cdot}571$. Now the relation between these two distances is what constitutes the neutralising power of the substance, taking for unity that of oxygen. In designating, therefore, this power by a, we shall have $a = \frac{b - 0{\cdot}878}{0{\cdot}571}$. If the number b were inferior to 0·878, this value of a would become negative, as it should be for representing a negative or acid neutralising power. It is only necessary to substitute for b in this formula the value of the affinitary number of each substance to obtain the corresponding neutralising power.

numbers, by which I have designated them.

These same numbers give us, besides, in forming their cubes, according to my principles, the atomic volumes which they should present in the solid state, taking for unity that of gold, allowing for peculiar circumstances of aggregation, which may modify, more or less, for each body, the principal influence of the electro-chemical quality, on its density, and, consequently, on its atomic volume.

Moreover, it may be conceived that even the affinitary numbers at which I have arrived in this memoir, are only approximative, and that rather different values would be found by bringing into their determination a greater number of compounds, so that even the order might be changed somewhat between the bodies nearest to each other in the series. It is for the ulterior researches of chemists and natural philosophers to render them more accurate, and to establish a perfect concordance between the results given by the two considerations of the atomic volumes and of the chemical relations between the bodies.

ON THE AMIDO-NITROGURETS OF TUNGSTEN.*

BY F. WÖHLER.

GAY-LUSSAC and Thenard prove that potassium and sodium, when heated, absorb ammonia with evolution of hydrogen, giving rise to dark green compounds called respectively *Ammonio-nitroguret of Potassium* and *Ammonio-nitroguret of Sodium*. The hydrogen evolved equals half the volume of ammonia absorbed. With water, these compounds are resolved into an alkaline hydrate and ammonia; heating transforms them into ammoniacal gas and a nitroguret; contact with water likewise gives rise to an alkaline hydrate and ammonia: therefore the composition of the nitroguret is

$$Po^3N, \text{ or } So^3N.$$

We must conclude, therefore, as do Berzelius and L. Gmelin, that the green compounds obtained by Gay-Lussac and Thenard are represented by the formulæ

$$PoNH^2, \text{ and } SoNH^2.$$

These properties of the alkaline metals may serve to throw some light on the nature of certain compounds formed by the action of ammoniacal gas on tungstic acid or chloride of tungsten raised to a certain temperature.

Bichloride of tungsten subjected to the action of ammoniacal gas forms a compound of nitroguret and amide of tungsten, called therefore *Amido-nitroguret of Tungsten*. The chloride of tungsten used in this preparation was obtained by burning metallic tungsten in chlorine gas free from atmospheric air. It was then quickly introduced into a long and perfectly dry glass tube, and a current of ammoniacal gas passed over it, and the tube occasionally shaken. It is unnecessary to apply heat at the commencement of the operation, the action of the ammonia on the chloride of tungsten developing sufficient heat to fuse part of the sal ammoniac formed and to volatilise the rest, which then condenses on the surface of the chloride. Towards the end of the operation, however, the application of heat is necessary, care being taken not to exceed the temperature at which the sal ammoniac sublimes. When all the chlorine is converted into sal ammoniac, and no more of that compound is formed, the tube is allowed to cool, the current of ammoniacal gas being kept up all the while.

The product of this operation is a black substance, exhibiting traces of fusion—an effect arising from the chloride of tungsten having been partly melted by the heat produced during the reaction. In this state it is denser, and has a kind of metallic lustre, similar to that of the graphite from gas-retorts. Heated in the air, it first gives off ammonia, then takes fire, and is converted into tungstic acid. Heated in a porcelain crucible, to a temperature near the melting point of silver, it loses its nitrogen and hydrogen, and is reduced to the state of metallic tungsten. It likewise behaves in the same manner when heated to dull redness in a current of hydrogen, a large quantity of ammonia being evolved. Fusion with hydrate of potassa converts it into tungstate of potassa, evolving ammonia and hydrogen. It is not acted upon by alkalies in the state of aqueous solution, or by acids; it retains with energy a certain quantity of chloride of tungsten or of sal ammoniac, and must, therefore, be purified by digestion, first in potassa-ley and then in ammonia, and afterwards washed with water, before it can be considered sufficiently pure for analysis.

The tungsten of this compound was estimated either as tungstic acid or as metallic tungsten. The quantities obtained in different experiments varied between 86·76 and 90·8 per cent., according to which results, the amount of the nitrogen and hydrogen varies between 13·24 and 9·2 per cent. The sample which contained 90·8 per cent. of tungsten yielded 8·26 per cent.

* *Annalen der Chemie und Pharmacie*, lxxiii., 190.

of nitrogen, by Will and Varrentrapp's method.

From these results it would appear that there exist two amido-nitrogurets of tungsten; and, indeed, the compound prepared by the process above described gives off ammonia with the greatest facility when heated, and is converted into a compound richer in tungsten; hence it is probable that a portion of this latter compound is formed during the preparation of the former. The compound formed directly by the preceding process is composed of

$$2WN+WNH^2.$$

It contains

	Calculated.			Found.
3W..	285	—	86·61	86·76
3N...	42	12·79	13·39	13·24
2H ..	2	0·60		
	329		100·00	100·00

Its formation may be represented by the equation

$$3WCl^3+9NH^3=W^3N^3H^3+6NH^4Cl+H.$$

On heating the compound in a current of hydrogen, it gives off 1 equivalent of nitrogen which is evolved in the form of ammonia, leaving a residue consisting of the second amido-nitroguret

$$W^2N+WNH^2,$$

distinguishable by the gray color of its powder. This substance contains:—

	Calculated.		Found.
3W	285	90·48	90·80
2N.....	28	8·89	8·24
2H.....	2	0.63	—
	315	100·00	

It is formed when the first compound is heated, the mixtures of the two produced varying, however, with the temperature; heating these two amido-nitrogurets reduces them to the metallic state.

OXYAMIDO-NITROGURET OF TUNGSTEN.

$$3WN+W^2NH^3+2WO^2.$$

This compound is formed by the action of gaseous ammonia on heated tungstic acid. It is not easily obtained in a state of definite composition readily giving off nitrogen and hydrogen when heated either in the air or in a current of hydrogen.

Crystallised tungstate of ammonia was calcined for the preparation of the tungstic acid used to prepare this compound. It was finely pulverised, then thinly spread over the inner surface of a long glass tube, and exposed to a current of ammoniacal gas. Heat was applied till a slight incandescence showed itself, the tube being frequently turned. The operation was complete when the evolution of water ceased. In the course of the process, the decomposing action which the compound exerts on gaseous ammonia becomes apparent. If the tungstic acid were placed in a porcelain tube, and the temperature raised to the melting-point of silver, nothing but metallic tungsten, or a mixture of the metal and the oxyamido-nitroguret, would be obtained.

This compound is of a pure black color. When made with non-pulverised tungstic acid—*e. g.*, in the state in which it is obtained by calcining tungstate of ammonia—it forms black scales, having a semi-metallic lustre. When heated, it gives off ammonia. It resists the action of acids and alkalies; but should the action of the ammonia on the tungstic acid not have been exhausted, potassa in the state of aqueous solution, disengages a small quantity of ammonia from the compound, and abstracts a corresponding quantity of tungstic acid. Hypochlorite of soda decomposes this compound, nitrogen being evolved, accompanied by an odor of chloride of nitrogen, and tungstate of soda is formed. Oxyamido-nitroguret of tungsten burns brilliantly when heated in the air, and is converted into tungstic acid. Like metallic tungsten and tungstic oxide, it burns when heated with red lead or oxide of copper. It is completely reduced to the metallic state by ignition in a current of hydrogen, water and ammonia being evolved. When heated with water in a sealed tube, it supports without alteration a temperature of 446° F.

This compound gave by analysis results nearly corresponding to the formula

$$3WN+W^2NH^3+2WO^2.$$

Its composition, in 100 parts, is as follows:

	Calculated.	Found.
Tungsten.....	88·04	88·03
Nitrogen	7·44	7·13
Hydrogen	0·27	0·20
Oxygen	4·25	4·64
	100·00	100·00

The mutual decomposition of tungstic acid and ammonia appears then to be less simple than might be supposed from considering merely the composition of these substances; for it might have been supposed that 1 equivalent of tungstic acid and 1 equivalent of ammonia would produce 3 equivalents of water and 1 equivalent of nitroguret of tungsten, W N, containing 87·11 per cent. of the metal, nearly the same as that contained in the oxyamido-nitroguret.

The latter compound, or, at least, a substance analogous to it, may be obtained by fusing, at a high temperature in a platinum

crucible, a mixture of tungstate of potassa with a large excess of sal ammoniac; the whole being covered with a layer of chloride of potassium. If the fused product be afterwards treated with water, and the tungstic acid removed by means of weak potassa-ley, a black, heavy residue is obtained, which is the new compound. When examined with a microscope, of the magnifying power of 100, it is found to consist of black metallic molecules. It is this substance which Wöhler, six and twenty years ago, erroneously described under the name of black oxide of tungsten.* It contains nitrogen and hydrogen, and gives off a large quantity of ammonia, not only by contact with alkalis, but even when simply heated by itself. The presence of the hydrogen in a compound formed at so high a temperature is difficult to account for, unless it be admitted that this hydrogen does not enter into the molecule until water is introduced. Another curious fact is, that this substance, when heated to whiteness in a close vessel, yields metallic tungsten. For the rest, this body exhibits the same characters as that which is obtained by the direct action of ammoniacal gas. It yielded between 88 and 89 per cent of tungsten; but when decomposed by a current of chlorine, which caused it to volatilise in the state of chloride and of acid chloride, it likewise left a residue of potassa, amounting to between 1 and 2 per cent.

When a mixture of tungstate of soda and sal-ammoniac is fused between a layer of chloride of sodium, and afterwards treated with water and a dilute solution of potassa, a dark brown substance is obtained which, when examined with the microscope, is seen to consist of a black and a dark copper colored substance. Wöhler is of opinion that the latter is the tungstate of tungstic oxide and soda which he described some time ago.

Brown oxide of tungsten, slightly calcined in a current of ammoniacal gas, likewise yields a hydrogenous and nitrogenous body, mixed, however, with unaltered oxide, which may be easily recognised by its dark brown color. When strongly ignited in a porcelain tube, it leaves the pure metal.

Berzelius states that tungstic oxide is reduced to the metallic state by strong ignition in a current of hydrogen. According to Wöhler's observations, on the contrary, tungstic acid is reduced to the state of tungstic oxide when heated in an atmosphere of hydrogen to the melting point of silver, but the oxide undergoes no further change. The observation of Berzelius probably applies to an oxide containing a small quantity of alkali. Tungstic oxide, when very pure has a fine brown color inclining to violet. Under the microscope it has a metallic aspect, very much like that of gun metal; it appears to be slightly fretted or crystalline.

Wöhler has not succeeded in obtaining a nitroguret of tungsten free from hydrogen. On calcining tungstic acid in cyanogen gas, a black substance, having a metallic aspect was obtained, and a considerable quantity of carbonic oxide. The black substance, when treated with potassa, yielded a little ammonia; nitrogen, therefore, enters into its constitution, but it likewise contains carbon. The amount of tungsten contained in it was 64·5 per cent.

* *Poggendorff's Annalen*, ii., 347.

ON THE CONSTITUTION OF SOME ALKALOIDS.*

BY THEODOR WERTHEIM.

When narcotine is treated at the temperature of 428° F by an excess of hydrate of potassa, or soda, we obtain as a product of the distillation a colorless liquid of a penetrating ammoniacal odor. When this liquid is diluted with a large quantity of water, there is developed besides the ammoniacal odor an odor resembling that of herrings. The taste of this dilute solution is slightly bitter. It possesses a powerfully alkaline reaction due to the presence of a liquid and volatile base. This base forms with hydrochloric and sulphuric acids salts very soluble in water and alcohol. Chloride of platinum forms in the alcoholic solution of the hydrochlorate an amorphous precipitate of a pale yellow; this double salt separates in orange-colored clots presenting the composition expressed by the formula—

$$C^6H^9N, ClH, PtCl^2;$$

The base C^6H^9N forms, as is evident, in the series of the ammonias the term corresponding to metacetic acid in the $C_nH_nO^4$ series of acids. It might be called *metacetamine*. But Mr. Wertheim proposes the more euphonious name of *œnylamine* or *œnylia*.

By treating morphia at a temperature of 392° F., with an excess of hydrate of potassa we obtain, as a product of distillation, a liquid which has a powerfully ammoniacal odor and a burning taste. Mr. Wertheim ascertained that this liquid contains methylamine: he prepared, with this ammonia-

* *Annalen der Chemie und Pharmacie*, t. lxxiii, 208.

cal liquid, and analysed, the double hydrochlorate of methylamine and platinum:—

$$ClH, C^2H^5N, PlCl^2.$$

Finally, the author announces that he has been enabled to prepare a series of salts of quinine which appear to him adapted for the determination of the equivalent and, consequently, of the exact formula of quinine. He obtained the sulphohydrocyanate of quinine in beautiful lemon colored crystals of great regularity. He likewise prepared the following double salts:—

Hydrocyanate of quinine and cyanide of platinum ..... $Qu,CyH+PtCy+1Aq.$
Hydrochlorate of quinine and cyanide of platinum ..... $Qu,ClH+PtCy^2.$
Sulphohydrocyanate of quinine and cyanide of mercury ...$2(QuCyS^2H)+HgCy.$
Sulphohydrocyanate of quinine and chloride of mercury...$3(QuCyS^2H)+HgCl.$

ON THE ACTION OF A MIXTURE OF BICHROMATE OF POTASSA AND SULPHURIC ACID ON THE FAT OILS.*

BY M. ARZBACHER.

When castor oil is distilled with a mixture of 4 parts of bichromate of potassa, 5 parts of sulphuric acid, and 2 parts of water, a very powerful reaction is produced. The mass commences by swelling up very much, and it is advisable, to prevent the mixture from passing over, to add the solution of chromic acid gradually. In this manner the reaction is regulated, and there distils over in great abundance an oil which floats on an aqueous and acid liquid. After having separated the oil by means of a florentine receiver, the author saturated the aqueous liquid with carbonate of baryta, and subjected the solution obtained to distillation as long as a neutral oil passed into the receiver at the same time as the water. The filtered residue was evaporated to dryness on a sand-bath, and the salt of baryta thus obtained was purified by crystallisation in alcohol of 85 per cent. Analysis showed the author that this salt of baryta crystallised in white and brilliant bractese was œnanthylate of baryta.

This result accords with the observations of Mr. Tilley, who, as is known, converted castor oil into œnanthylic acid by distilling it with nitric acid. This œnanthylic acid, the author likewise found in the oil which he had separated from an aqueous liquid produced by distillation. After having extracted it by means of a solution of soda, he obtained a neutral oil which he distilled, dried and purified by another rectification. It was a colorless, fluid liquid, possessing a peculiar odor and a burning taste. It was insoluble in water, and soluble in all proportions in alcohol. The alcoholic solution formed with nitrate of silver to which a little ammonia was added, a precipitate which was at first white, but which rapidly blackened in the light. An aqueous solution of nitrate of silver heated in a sand-bath with this oily liquid was reduced, and the silver was deposited in the glass forming a mirror. These reactions indicate that the oil in question possesses some of the properties of an aldehyde. The composition of this body seems to corroborate this supposition. It is expressed by the formula $C^{16}H^{16}O^2$, according to which this body would be nothing more than valerianic aldehyde. The author has endeavored to confirm this supposition by treating his oil by potassa. He thus obtained a small quantity of an acid with which he formed a salt of silver. But the quantity of salt which he prepared was too small to be submitted to elementary analysis, so that he is still in doubt as to the real nature of the neutral body formed in the reaction of chromic acid on castor oil.

Poppy oil, treated in the same manner, furnished the same products; œnanthylic acid and the oily and neutral body which is identical or isomeric with valerianic aldehyde.

* *Annalen de Chemie und Pharmacie*, lxxiii, 199.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

ON A DIRECT METHOD OF OBTAINING IODINE FROM CERTAIN SPECIES OF SEA WEEDS ON THE LARGE SCALE, WITH A MODE OF PROCURING IT AS A SUBSIDIARY PRODUCT ADAPTED TO COAST FARMS.*

BY GEO. KEMP, M.D. CANTAB. FELLOW OF THE CAMBRIDGE PHILOSOPHICAL SOCIETY.

On all the sea coasts the marine vegetables may be classified according to the depths at which they are found; for our purpose it will suffice to include them under two general heads, the shallow and deep-water sea-weeds;—those above and those below deep-water mark. The *Fucus vesiculosus*, *F. serratus*, *F. nodosus* and *Halydrys siliquosa* are specimens of the first division, and *Laminaria digitata*, *L. saccharina* and *L. bulbosa* of the second. Nature, equally provident and fertile in her resources, seems to have destined these marine productions to act as storehouses for the accumulation of certain inorganic bodies essential to terrestrial vegetation which otherwise would soon become out of human reach. The more soluble portions of the granite, felspar, clay-schist, &c., which by attrition and solution are rapidly conveyed to the sea, are thus again presented to the agriculturist in a condition well adapted for assimilation by the organs of plants.

Analysis proves that the metallic base preponderating in the Fuci is sodium,† combined with oxysulphion, chlorine, and small quantities of iodine and bromine; whilst the plants flourishing in what Prof. E. Forbes calls the laminarian region, contain a preponderating quantity of potassium, with much more iodine than the former species, and are therefore of more interest and importance to the manufacturer. Various experiments proved that, in the earlier periods of growth, iodine is almost absent, progressing with the advance of the plant, and is at the maximum, at the precise period when the weed yields to the autumn tempests and is drifted on the shore, thus rendering unnecessary the expense and risk of gathering it from the rock.

All sea-weed contains a very large proportion of water; this can easily be removed from the small shallow water species by exposure in summer to the wind and sun; in the other species, on the contrary, even under the most favorable circumstances, decomposition will occur before the plant can be brought into a fit condition for combustion; the consequence is, that the kelp process is chiefly confined to a species which contains but a small portion of iodine, at a period of the year at which the other species has not arrived at maturity. This is not all. The temperature, in forming kelp, cannot be so nicely controlled as to prevent the more volatile iodides from being dissipated, or more frequently, lost by mechanical agency, the very nature of the operation setting in motion a brisk current of hot air. Besides, the smoke arising from the combustion of *Laminaria digitata* in particular, is most offensive; and unless the wind is blowing off shore, burning the weed on the large scale would be prohibited: these circumstances induced the writer to seek a method of obviating these evils; to do this it became necessary to determine what portion of the plant contains most of the element sought, and whether it would not be practicable to arrive at the desired result by mechanical means.

A transverse section of the stem of the *L. digitata* presents, externally a thin cortical layer, next a mass of condensed cellular tissue, and internally a transparent medullary central portion, generally of an elliptical form. Applying to the surface a weak solution of acetic or hydrochloric acid, we envelope it with a thin layer of starch paste, and cautiously expose it to the action of chlorine, from the mouth of a bottle containing a solution of that gas. The iodine being set free, and rendering its presence perceptible through combination with amylon, will be immediately proved to be enveloped in cells be-

* *Chemical Gazette, July 1st*, 1850.

† Prof. Thompson states, on the authority of Gaultier de Claubry, that the *Fucus serratus* contains more iodine than *F. digitatus* or *vesiculosus*. The experience of the author is directly the reverse, presuming that the *F. digitatus* is identical with that now denominated *Laminaria digitata*.

tween the external cortical and central medullary portions. We now entertained hopes that the object sought after would at once be arrived at by exposing the stem of the plant to pressure and from the liquid obtained, which it was presumed would contain the greater portion of iodides in solution, without further trouble liberating the iodine itself; but, so condensed was the cellular tissue found to be, that on exposing a portion not exceeding a cubic inch, to the pressure of a ton weight, a very small portion of fluid was obtained. It was determined, therefore, to break up the cellular tissue as completely as possible by rubbing the stem on an ordinary domestic grater; this completely succeeded, and the iodine was liberated by ordinary chemical operations with the greatest ease. This plan was thus adapted for application on a large scale: a turnip cutter was furnished with a small band-wheel six inches in diameter; this was connected by means of a band with a wheel five feet in diameter, which in working revolved eighty times per minute, thus communicating to the smaller wheel a velocity of 800 revelutions per minute; and the machine being supplied with the stem divested of roots and terminal leaves, it was cut into thin slices with great rapidity. The mass of slices having been left in a heap for twelve hours, a species of fermentation commenced, with evolutions of heat and other phenomena, reducing the mass to a pulp without further trouble, which when submitted to adequate pressure, completed the object in view. The fibrous tissue left in the press still contains iodine; but it is so easily charred at a low temperature, that on a large scale this method will probably be preferred.

With reference to the *Laminaria saccharina*, which in the autumn is very rich in iodine, it is only necessary, after collecting it, to heap it up in vats with a tap at the bottom to let the liquid escape. For some hours sea-water alone runs off; but at a certain stage active fermentation sets in, and immediately the presence of iodine in the liquid is indicated the tap should be closed, and the contents of the vat occasionally stirred for twelve hours, when they are reduced to a soft pultaceous magma, the addition of quicklime in sufficient quantities completes the process; almost all the iodides in solution may be removed by expression. Where lime is expensive, charring may be resorted to.

Should the object be to save the iodine, various methods may be adopted; if it be a consideration to obtain the potassa salts, evaporation, and probably repeated crystallisations, must be resorted to. Whilst iodine remains of importance only in a pharmaceutical point of view, such a supply as could thus be obtained would materially affect the market; but should it be adapted to dyeing purposes, the application of sufficient capital would doubtless be attended with very profitable results.

On coasts similar to that of which we especially speak (the Isle of Man), numerous creeks occur, which belong to farms in their immediate neighborhood; in these, immense quantities of drift-weed accumulate after every storm, which in many cases are entirely wasted, and in many others have to be conveyed inland by roads almost impassable. Taking Professor Forchammer's estimate, that each ton of sea weed is reduced by drying to 500 lbs. of solid matter (and, so far as the writer's experience is concerned, this estimate is far above the mark), in every ton of *wrack* conveyed, the farmer carts away 1740 lbs. of water, whereas his object is merely to supply his land with the salts of potassa and soda. It will be necessary to make a digression before describing the author's practical method for attaining this object.

The mutual reaction of free iodine and starch is well known, but little attention has hitherto been bestowed on the circumstance, that the facility with which iodine is precipitated from its solutions by means of starch varies exceedingly. The object of the writer being to fall on some plan involving little expense and chemical knowledge, to effect the complete precipitation of free iodine from its solutions, he minutely investigated the subject in detail; it was then discovered that the facility with which the amylon of starch is precipitated, depends in a great measure on the size of the starch granule. This leads us to suppose that the vesicular covering of the granule is the substance which combines with the iodine, or that the solution of iodine enters the vesicle by means of endosmose; in either case the practical result is the same. Now, according to Raspail, the granule of millet-starch is only $\frac{1}{1000}$th, that of wheat $\frac{1}{500}$th, whilst that of the potato is $\frac{1}{350}$th of an inch in diameter, By taking advantage of this circumstance the facility of precipitation is much increased, especially as this kind of starch may be obtained at the least cost. By adding a solution of ammonia to a solution of the neutral acetate of lead, we obtain, as is well known, the tribasic acetate of lead, $PbO(C^4H^3O^3) + 2PbO$. Adding a solution of this compound to starch forms an insoluble compound of starch with oxide of lead; and by using

this substance, we can in a few seconds precipitate any quantity of iodine from a solution; in consequence of the weight and density of the precipitate we can decant the supernatant liquid, and wash the precipitate without loss. Let the potato-starch be formed as usual, by grating and washing, and then strained through a sieve or coarse linen; the turbid liquid should now be allowed to repose for a few minutes, and the supernatant milky fluid be poured off; the residuum is again washed, and treated in the same manner, until the precipitate subsides rapidly, and the liquid clears in a few seconds; the smaller granules are thus removed: then add a strong solution of the acetate of lead, with the addition of caustic ammonia, and the compound washed for is ready for use, or it may be strained through flannel, dried, and kept ready for application.

The sea weed being collected in heaps may be suffered to drain itself of the sea-water retained about it: in the meanwhile women and children can trim the stalks of the tangle (*Laminaria digitata*) of leaves and roots, and arrange them ready for the turnip cutter and other above named operations. The remainder may be conveyed into old hogsheads, in a sheltered spot near the beach and allowed to ferment; the succeeding operations have been described. To the liquid is added commercial hydrochloric acid, until a very marked acid reaction is obtained; a solution of ordinary chlorinated lime is then added, to disengage the iodine, taking care not to use an excess; the brown color of the liquid will increase up to a certain point, and the smallest addition of chlorine when this has been attained, will diminish its intensity. Having thus liberated the iodine, it is precipitated with the prepared starch diffused through water, continuing its addition until it is no longer rendered blue by the iodine. Decant the fluid portion, and strain the residuum, which when dry will be immediately available to the iodine manufacturer, from which the iodide of potassium may be formed by the addition of sulphuret of potassium, or other appropriate means. The fluid portion is rich in potassa, soda and magnesian salts, and forms a most important contribution to the liquid-manure-tank, or may be thrown over the compost in the farm-yard, with the additional advantage of fixing the ammonia through its excess of hydrochloric acid. The cakes of cellular tissue should be stored in a dry place, and made use of as fuel for steaming turnips, and other similar operations, taking care to preserve the ashes: these should also be lixiviated, and thus every particle of iodine may be saved.

PHOTOGRAPHY ON GELATINE:—MEANS OF OBTAINING VERY CLEAR AND VERY TRANSPARENT NEGATIVE PROOFS, CAPABLE OF BEING TRANSFERRED A GREAT MANY TIMES ON ORDINARY PHOTOGRAPHIC PAPER.

BY M. A. POITEVIN.*

In order to prepare the layer of gelatine on which I make my negative proofs, I dissolve in 100 grammes of water 6 grammes of gelatine of good quality (that which is met with in commerce, and which is used for preparing jellies for food succeeded best). This size should not contain salts soluble in water; it should also be as free as possible from fatty matters. To make the solution, I steep the gelatine in distilled water for 10 or 15 minutes; I slowly heat over a spirit lamp, and agitate continually until the solution is complete. If any scum forms, I carefully remove it by means of blotting paper, which I draw over the surface; I strain it through a very fine cloth, previously damped, and I again skim the surface on which a few striæ form, arising, doubtless, from fatty matters which escaped the first skimming.

The gelatine being thus prepared, I take, with a graduated pipette, a determinate quantity. and I run it over a very even plate of glass placed horizontally; a layer of $1^{mm}50$ is sufficient; this quantity is equivalent to nearly 20 centimetres of solution for a surface of half a plate having $13^{c}5$ or $17^{c}5$. A thicker layer would not be injurious, but a thinner one might present some inconveniences.

Before running the gelatine on the glass plate, a thin layer is applied to it by means of a cloth impregnated with a solution of gelatine, rather more dilute than the foregoing; afterwards, the glass plate is gently heated by means of a spirit-lamp; then the solution of gelatine is run on, and flows uniformly over the plate. The under side of the glass plate is again heated, but with moderation, in order to give fluidity to the gelatine, and is allowed to cool.

The plate being thus prepared, I plunge it into a solution of acetate of silver, keeping the surface covered with gelatine underneath, and inclining it in the solution until the latter has completely moistened it; I then turn the glass plate and immerse it

* *Comptes Rendus*, No. 21, 27, May, 1850.

completely in the solution; then I pass a very soft pencil several times and in different directions all over the gelatinised surface, in order to dispel the bubbles of air which may adhere to it, and, before withdrawing it, I blow on the surface to ascertain whether the solution has moistened it all over. I then remove the plate, and holding it somewhat inclined, I pass the pencil already used over the whole surface, taking care to cover the edge of the previous stroke with that of the following one. I then dry the under side of the plate and place it horizontally until the surface is dry, which requires five or six hours.

I ordinarily prepare over-night the plates which I intend to use on the following morning, and in the morning those which I mean to use in the evening. It is important that no free liquid should be left on the surface of the plate when it is required for use, for the preparation would be removed at the places where any remained. This preparation should be made out of the solar light. The plate covered with the solution of acetate of silver should be kept out of the light.

The solution of acetate of silver is prepared by making a saturated solution of acetate of silver, to which half its bulk of water is added. Admitting that 100 parts of water dissolve, at the ordinary temperature, 0·5 gr. of acetate of silver, to prepare 0·750 lit. of the solution which I use, I dissolve 2·5 gr. of acetate of soda in 15 grammes of water; I likewise dissolve 3·03 gr. of nitrate of silver in 10 grammes of water; I add the solution of nitrate of silver to the solution of acetate of soda, and I receive the acetate of silver which is precipitated on a filter, I wash the precipitate in a stream of water, then I pass through the filter several times 0·50 lit. of water; almost the whole of the acetate of silver should then be dissolved; I afterwards add 0·25 lit. of water to the half litre of saturated solution.

In this operation, 3 grammes of acetate of silver are formed, the 0·75 lit. should contain only 2·50 gr., but I put in a little more of it to make up for any that may have been lost in the water of the solutions and of washing. The acetate of silver being very easily altered by the solar light, I make this solution as far as possible in a dimly lighted place. I preserve it in a bottle covered with black paper, and filter it every time I use it.

I expose the plate prepared as above described to the vapor of iodine, in the same manner as a plate of silvered copper; only, for this exposure, account must be taken of the time, for we cannot judge of the tint on the surface, only the time of exposure is shorter than for silvered plates. The iodised plate is placed in the frame of the camera obscura, and then I cover the side which is not gelatinised with a piece of card-board covered with black cloth. It is good to allow some time to elapse between the iodising and the exposure to the focus of the camera; the plate thereby gains in sensibility. I have sometimes used plates five or six hours after the iodising; they had lost nothing of their sensitiveness.

The sensitiveness of these plates is about one-fourth of that of plates prepared with iodine and bromine. For a landscape with much light and with an object-glass with a small diaphragm, the exposure in the camera may require from 80 to 100 seconds. Portraits, with strong lights and shades, may be taken in two minutes with the portrait object-glass. I have tried the effect of the vapor of bromine on these plates, and have found that it renders them more delicate. I have not made sufficient experiments to have certain data on this subject.

In order to make the image appear, I plunge the plate into a solution of gallic acid containing 0·1 gr. of gallic acid in 100 grammes of water; I leave the proof until the shadows appear sufficiently intense. This immersion may last an hour or an hour and a half. With a more concentrated solution of gallic acid, it would require a shorter time, but it would be more difficult to regulate its action. At the commencement of the immersion, a positive image is formed on the surface of the gelatine. This image becomes more and more dark; but, on looking through it, the parts corresponding to the shadows in nature remain very light.

To fix the proof, it is washed in ordinary water, and then left for about a quarter of an hour in a solution of 1 gramme of hyposulphite of soda in 100 grammes of water; it is again washed in ordinary water, and it is steeped for the same length of time in a solution of 1 gramme of bromide of potassium, in 100 grammes of water.

I wash the proof with ordinary water, allowing it to remain in it for fifteen or twenty minutes; then I wash with distilled water, and allow the layer of gelatine to dry in the open air. It is then a very clear negative proof, capable of giving positive proofs, with ordinary photographic paper, in the sun, in from two to 10 minutes, according to the vigor of the negative proof: it also comes very well in the shade.

It is well to renew, at each operation, the

solutions of gallic acid, hyposulphite of soda and bromide of potassium.

In this operation, if the solution of gallic acid be replaced by a solution of sulphate of protoxide of iron, very beautiful positive proofs are obtained.

PHOTOGRAPHY ON PAPER.—MEANS OF OBTAINING THE IMAGE IN THE CAMERA OBSCURA ON DRY PAPER.*

BY M. BLANQUART-EVRARD.

To render the execution of photography on paper simple, sure and easy to those least experienced in chemical manipulations, should be the object of the efforts of those who wish to bring this art to its most useful application in industrial economy. The first condition for entering into this new order of things, is to rid the operation of the care which it requires at the time of the exposure. We open the way by giving here:—

1. The means of operating on dry paper, instead of damp paper, freeing the operator from the difficult preparations which he has to make at the places of exposure.

2. So simple a mode of preparing this photogenic paper, that it may be manufactured and sold to the amateur, who does not desire the trouble of preparing it himself.

The papers prepared by the means hitherto described could not be brought to the dry state without afterwards taking, under the action of gallic acid, an uniform coloration which would efface the photogenic image, and cause it to completely disappear. Serum has the property of obviating this inconvenience; the following is the mode of preparation to be adopted.

Collect, by filtering, the clear part of milk which has been turned, and beat up in this serum the white of one egg to each pint, then boil in order to remove all the solid matters, and filter again, after which dissolve without heat 5 per cent. by weight of iodide of potassium. The paper to be prepared must be very thick and steeped entirely in this liquid for two minutes, and afterwards dried by hanging it, by means of two pins, by two of its corners, to a line.

This preparation is made in the daylight without any particular precaution; the paper is fit for immediate use, for six months after, and certainly after a much longer time. When it has to be used, it is submitted to a second preparation which is done by candlelight, and as short a time as possible before the exposure; it is however still capable of giving good results several days after, avoiding then, as much as possible, leaving it in a high temperature.

We proceed therefore in this preparation as we directed in our communication of January, 1847, by covering a glass with aceto-nitrate of silver composed of 1 part of nitrate of silver, 2 parts of crystallisable acetic acid, and 10 parts of distilled water. On this substance is deposited one of the sides of the paper which is allowed to imbibe until it has become perfectly transparent, which is ascertained by raising it between the operator's eye and the candle, after which it is dried between several folds of very white blotting paper, and left so until it has to be placed in the frame, behind a sheet of very clean and dry paper, and between two glasses, as in the moist operation previously described.

The exposure to which we afterwards proceed, next day, varies, according to the light and the power of the object-glasses, from one to five minutes.

On returning to work, the part of the paper which has been presented to the light is deposited in a saturated layer of gallic acid, taking care to secure the other side from any trace of gallic acid which would stain it. The image is gradually formed and finally acquires as powerful tones as can be desired: it is then washed in a great quantity of water, then passed into a solution composed of 1 part of bromide of potassium and 20 parts of water, in order to dissolve the unreduced salts of silver, then again washed to remove all traces of this bromide, whose action, by continuing, would destroy the image, and finally dried between folds of blotting paper.

PREPARATION OF THE DRY ALBUMINOUS PAPER.

The paper prepared by albumen has analogous properties to that in the preparation of which serum is used, but in an inferior degree; like it, it remains good for an almost indefinite period after the preparation with the iodide, but, after having been submitted to the aceto-nitrate of silver, it can be scarcely kept beyond next day. The proofs given by the preparation we are about to describe are admirable; not so fine as those on glass, they have more charms, because the contrasts are less decided, and they possess more harmony and softness. We think that it is a real acquisition for those who seek the effects of art in the results of photography.

* *Comptes Rendus*, No. 21, May 27, 1850.

White of egg, to which have been added thirty drops of a saturated solution of iodide of potassium and two drops of a saturated solution of bromide of potassium to each white of egg, is beaten up to a snow. It is left to repose until the snow returns to albumen in the liquid state, and then filtered through silk or clear muslin, the albumen being collected in a large and quite flat vessel. The paper to be prepared is then deposited on the layer and left on it for a few minutes. When it is covered with albumen, it is raised by one of its corners, and allowed to drain and dry by suspending it by one or two corners from a line.

The preparation with the aceto-nitrate is, in every respect, the same as that described for the paper prepared with serum; care must be taken to dry it between two folds of blotting paper only when the paper has acquired complete transparency. It is put into the frame for exposure in the same manner, the appearance of the image and the rest of the operation is the same; but the exposure requires a longer time, generally four or five minutes.

PREPARATION OF THE POSITIVE ALBUMEN PAPER.

The positive paper prepared with albumen gives somewhat less brilliant proofs, but of a richer tone, and of a more agreeable finish and transparency; it is prepared in the following manner:—

To the whites of eggs is added 25 per cent. (by weight) of water saturated with chloride of sodium. The white of egg is beaten into a snow, and filtered as in the preceding preparation, only in this case the paper is left on the albumen for only half a minute. It is then hung up to dry, which is accomplished in six or eight minutes; it is afterwards deposited in a vessel containing 25 parts of nitrate of silver and 100 parts of distilled water. The paper is left in the bath at least six minutes, and afterwards dried flat, as described in our communication of January, 1847.

ON IMAGES OF THE SUN AND MOON OBTAINED ON GLASS BY PHOTOGRAPHY.*

BY M. NIEPCE DE SAINT-VICTOR.

HAVING lately heard M. Arago state at the Academy, that proofs of the Sun had been taken on plates of silver, I wished to see the effect produced on a sheet of glass covered with a layer of coagulated albumen, which, as is known, gives an inverse or negative proof.

I operated in the following manner:—having prepared my glass plate, without employing any means of acceleration, I exposed it in the camera-obscura of which the object glass (I operated with an object glass for a fourth of the plate) was in the direction of the Sun, the image of which I had placed in the visual focus, which in this object glass corresponds exactly to the photogenic focus.

My first experiments were made as quickly as possible, that is to say, as quickly as I could uncover and cover the object glass, operating with a diaphragm of 5 millimetres in diameter. Notwithstanding this, the image came too rapidly; on submitting the plate to the action of gallic acid, it became quite black. I then conceived the idea of raising the diaphragm and leaving the object glass uncovered long enough for the image to appear without the aid of gallic acid, and this succeeded.

The first plate was exposed five, and the second ten seconds.

These were the results I obtained:—the first plate showed a very visible and distinct image, of a blood-red color, much deeper in the middle than at the edges, as any one may see by examining the plate.

The second plate presented the same difference between the centre and the circumference, but with greater intensity; besides which, it had a circle beyond the image, in the form of a glory.

The different intensity of the centre and the edge is so much the greater as, notwithstanding the effect of contrast, it is still very perceptible, especially when examined by the microscope. And by the same effect of contrast, if the image is blackened with gallic acid, the reverse effect takes place.

I have made more than twenty proofs, and almost always with the same results.

The results of these experiments are quite in conformity with the opinion announced by M. Arago, that the photogenic rays emanating from the centre of the Sun have more action than those near the edge or circumference.

I tried, and with success, to take the image of the Moon in twenty seconds, the Moon being at the full, and perfectly in the focus of my object glass; and without using an heliostat, I obtained a very round image. But the rapidity with which I operated was so great, that the Moon had not time to move perceptibly; for I should say that if left for thirty seconds we should have rather an oval image.

To obtain an image of the Moon, I found it necessary to operate in the speediest manner, such as would enable me to take a

* *Comptes Rendus*, No. 22, June 3, 1850.

proof of a landscape illumined by diffused light in one, or at most two, seconds.

I obtained this great rapidity by new means which I have lately consigned to the Academy in a sealed packet. This packet likewise contains a means analogous to that which M. Blanquart has just published * for operating in the dry way on paper; I likewise explain the way to prepare paper with albumen for positive proofs. I propose to make these processes known when I have concluded the works with which I am at this moment occupied.

ON VARIATIONS IN THE CHEMICAL COMPOSITION OF WATER AS AFFECTING ITS AGRICULTURAL USES.

BY PROFESSOR WAY.

At a meeting of the Royal Agricultural Society of England, held in Hanover Square, on Wednesday, the 19th June, Professor Way delivered the following lecture on the above subject:—

He commenced by stating that he intended on that occasion to call the attention of the members to three important heads of inquiry connected with water, more with a view to elicit from them practical illustrations founded on their individual experience, than to offer to them anything particularly novel or established. These heads of enquiry were the following; namely:—

I. On Water for Steam and other Boilers: the means of ascertaining its comparative suitableness for that purpose, and of counteracting its tendency to incrustation.

II. On Water for Irrigation: its chemical impregnation, and the theory of its action.

III. On the influence of Water, obtained under different circumstances, on the health of Cattle, Horses, and other live stock on a farm.

He remarked that, as the first head of enquiry related to the mechanical and chemical agency of inert matter, its details came within the range of analytical investigation, and he should be able to speak with much confidence on the facts which he had to bring together under it; but as the other two heads included a reference to local circumstances, and to the influence of the vital operations of vegetation and animal physiology respectively, in the production of results, what he had to say on these points would be much less decisive, and advanced more for the purpose of seeking than of giving information.

* See page 502.

I. WATER FOR STEAM BOILERS.

The water from the clouds reaches the earth almost pure in a chemical sense, as an homogeneous liquid, composed of the elements oxygen and hydrogen. It is distilled from the sea and land, and from the leaves of vegetables, in a state of purity, and forms clouds; from which it again falls at intervals to the earth through the atmosphere, bringing with it only very minute traces, varying according to circumstances, and frequently inappreciable to the chemist, of carbonic acid gas, ammonia, nitric acid, and the effluvia arising from animal perspiration and the decomposition of animal matter. On reaching the land, however, its solvent power immediately comes into operation, and it becomes impregnated more or less with the soluble substances with which it comes in contact; common salt and gypsum are always dissolved by it, while lime and other substances are taken up by it when there happens to be an excess of carbonic acid gas present. In order to illustrate this fact, the Professor exhibited a simple and striking experiment.

Three glass vessels were connected by means of bent glass tubes; the first vessel contained fragments of marble (as a pure variety of native carbonate of lime); the second, distilled water; and the third, a clear solution of quick-lime in pure water (lime-water). On gradually adding dilute hydrochloric acid to the marble in the first vessel, carbonic acid gas was disengaged in great abundance, which, passing through the tube into the middle vessel, was there washed and freed from impurity by its passage through the distilled water, and then proceeded, by means of the connecting glass tube, to the lower part of the inner surface of the third vessel, where it continued to bubble through the clear lime-water. After a few moments the lime-water became turbid. The Professor remarked that this effect resulted from the conversion of the lime into insoluble carbonate of lime (or chalk), by its combination with a first proportion of the carbonic acid gas passed through it. In a few minutes, more, however, the liquid regained its transparent appearance. This change, he explained, arose from the further supply of the same acid gas, forming the insoluble carbonate of lime into a soluble super-carbonate of that earth; the liquid, in fact, being then a solution, not of lime in water, as it originally was, but a solution of bicarbonate of lime, or of chalk rendered soluble by excess of carbonic acid. To prove that this was the case, the Professor took the flask containing this solution, and having placed it over a spirit-lamp, caused ebullition to take place.

After boiling for a short time, the liquid again became turbid, from the circumstance of the heat expelling the excess of carbonic acid, and again reducing the bicarbonate of lime to the state of insoluble chalk.

He then proceeded to show how this experiment illustrated the change which was found to take place in the waters of limestone districts, which were naturally charged with carbonate as well as with sulphate of lime; and also how it happened, that while water, rendered hard by sulphate of lime only, did no injury to steam-boilers, as that salt was not deposited on raising the water to a boiling temperature, hard water, on the contrary, holding a large amount of carbonate of lime dissolved in it by carbonic acid, did the greatest injury to them, by gradually depositing, on being boiled, carbonate of lime at the bottom of the steam-boilers, until it amounted to a hard calcareous incrustation. Water is always rendered hard by holding in solution either the carbonate or the sulphate of lime; and, accordingly, when obtained from wells in the chalk, oolitic, and limestone districts throughout the kingdom, is always hard; becoming turbid when boiled, and depositing its carbonate of lime on that part of the internal surface of the boiler nearest to the fire. As a familiar instance, he named the fur or crust in tea-kettles, in districts where such water is used; but in case of steam-boilers, this deposit was one of the greatest evils that could be imagined. The hard calcareous incrustation in immediate contact with the iron plating of the boiler, amounting in a few weeks to no less than from two or three inches in thickness. Prof. Way explained how the injury arises in this case; namely, from the effect which the adhering crust has in preventing the transmission of the heat, received by the boiler from the fire, to the body of water within the boiler. He cited many curious instances of the cooling effect of this free transmission of heat on substances under other circumstances most fragile and combustible; and the contrary effect when the transmission of such heat was obstructed, as in the case of calcareous incrustation, when the heat was arrested by the solid slow-conducting body, and the temperature raised above that of boiling water. He stated that, however odd it might sound to make the statement, it is no less true, that water may be boiled in an orange-peel, in an egg-shell, or in a vessel made of thin wood, or even of common writing-paper; the heat applied to the external surface being rapidly transmitted to the water, and the heat carried off in the steam generated, while the material employed for the boiler suffers no injurious effect from such application of heat. He related a singular instance of this kind, in the case of a person at Liverpool, who had frequently had his cotton mill burnt down. The party in question, imagined, that if he had a large reservoir for water placed at the top of his factory, constructed of wood instead of metal, the wood, in case of fire, would be immediately burnt to ashes, and the water would consequently be set at liberty and extinguish the fire. The fire unfortunately did break out again, as it was feared it would, but the wood, instead of being charred or burnt, remained entire, and, being encircled by the flames, the water continued to boil in its wooden reservoir as long as any remained.

The furring of a boiler preventing this transmission of heat, and thus causing injury to the substance of the boiler, was the reason why, in some districts, where the water was charged with bicarbonate of lime, the boilers were found to wear out sooner than in others, and why the railway companies had been led either to seek for soft water, or to soften the hard water they had been in the habit of using, by the addition of some substance that would prevent its furring their boilers.

The London and South-Western Railway Company had used the substance known in commerce as sal ammoniac, with great success, by dissolving one ounce of it in 90 gallons of water, in tanks kept especially for the purpose. This substance was the neutral salt, so long familiar to chemists as hydrochlorate of ammonia, being a compound of hydrochloric acid and ammonia. Its action in removing the hardness of water arising from bicarbonate of lime was explained by Professor Way in the following manner. When hydrochlorate of ammonia and carbonate of lime are brought together in solution, a double decomposition ensues, each of the four combining substances changes its relative position, and two new salts are the result: namely, carbonate of ammonia, which is volatile, and accordingly makes its escape into the atmosphere; and chloride of calcium, one of the most deliquescent salts with which chemists are acquainted, and which, consequently, remains in the water in a state of perfect and almost permanent solubility. It may, he remarked, be said, that the ammonia of the sal ammoniac carried off the carbonic acid, whilst the hydrochloric acid dissolves the lime, thus liberating the water from the chemical conditions by which its hardness was occasioned.

Professor Clark, of the University of

Aberdeen, however had proposed a plan for softening water rendered hard by carbonate of lime, which Professor Way considered much better than the one just described, and which might be adapted to the uses of agriculturists. This plan consists in adding to such water a certain quantity of quick-lime, which will unite with the excess of carbonic acid, and become converted into carbonate of lime, at the same time that it would reduce by such abstraction the bicarbonate also to a state of carbonate, and both being insoluble, they would, of course, fall as precipitates to the bottom of the vessel, or other enclosure in which the water was contained, leaving the water entirely free from the bicarbonate of lime to which its hardness had in a great measure been owing. He then proceeded to describe Professor Clark's system of soap-tests, for ascertaining the relative degrees of hardness possessed by certain waters. He remarked that hard water, as well known, curdles soap, which will not produce a lather until such hardness has been overcome. Professor Clark had recommended a solution of white curd-soap in spirit of wine of a certain strength to be employed in his testing. This solution will at once produce a lather with soft water, but not with hard water until a certain quantity of the solution has been added to it for the purpose of counteracting the hardness: when lather of a proper firmness has been gained, the amount of standard solution employed to produce the effect indicates the degrees of hardness of any particular water; thus a standard of comparison is established, by which the choice as to different sources from which it would be most advantageous to procure water can be satisfactorily determined.

Professor Way then performed an experiment with this soap-test, on spring water from the chalk at Croydon, in comparison with water from the Thames, the former indicating a hardness of about 18°, and the latter of about 15°. The operation consisted simply in adding to the water, from a graduated pipette or suction tube, successive measures of the solution, until the water when shaken up maintained a lather on its surface for five minutes. The number of measures then indicated the quality of the water, two soap measures being equal to one degree of hardness. The process he described as easy, exact and simple; and one which might be practised by any gentleman who was interested in such subjects without spoiling his furniture It will also indicate the hardness resulting from the presence of sulphate of lime, as well as that from the bicarbonate; though, as he had previously remarked, water hardened by sulphate of lime offers no objection for use in steam boilers, as the sulphate does not become deposited by boiling, as is the case with the carbonate; in an economical and domestic sense, however, water rendered hard by either of those salts of lime is objectionable.

Professor Way then observed, that Professor Clark, in recommending quick-lime to soften water containing the bicarbonate, advised such quantities of lime to be added as a preliminary trial by the soap-test process should indicate as being requisite. Such water would, by this process, be rendered soft for domestic purposes, and for steam and other boilers. The only difficulty consists in tanks being required for the due subsidence of the chalk thus brought into an insoluble state in the water; but that is an obstacle which will no doubt be surmounted; for when it is considered how great the benefit of this plan would be found, not only in ordinary families, but in union-houses and prisons; that it is estimated that in London alone £600,000 is expended every year in the purchase of soap, one half of which is wasted in the hardness of the water; and how important a point it is in the processes of bleaching, dyeing, and other staple manufactures carried on at Bolton, Manchester, Bradford and other places, to have a soft water in which lime is absent; it would, he thought, be well worth the while of all parties interested in so important a question to make arrangements for the depositing tanks required.

The Professor concluded this part of his subject by throwing out hints by which soft water might perhaps be artificially obtained on a large scale and at little cost where it did not occur naturally. He remarked that water is found by experience to become softened by passing through the soil; water only, however, which is rendered hard by the bicarbonate of lime. Thames water filtered through clay made permeable by sand, is found to become as soft as by Professor Clark's process. Drainage water through regularly permeable stiff soils is more suitable for steam engines than spring water. But whether water, thrown over the land would by that means become soft, he was not prepared to say. When, however, it is considered that one acre of land receives every year on an average 500,000 gallons of pure rain-water, sufficient for the wants of 35 people during that period, it may be a question whether poor sandy land or bad moorland might not be covered with flat tiles for the purpose of collecting the

rain-water, which might be conveyed in earthen pipes to the places required for its use. He merely offered this suggestion for the consideration of parties more conversant than himself with the practical bearings of such an undertaking.

II. WATER FOR IRRIGATION.

Prof. Way remarked that, for the purpose of irrigating, he thought that water should be hard, and not soft, as for other purposes: and it should contain the sulphates and carbonates of potassa, soda and magnesia, including organic matter, as all these are substances that would be taken up and retained by the land. If this view of the subject were the correct one, it would follow that the water in granite districts would, from its softer nature, not be so useful in irrigation as that in other districts where lime and other earthy substances were dissolved by the water passing through them. On a former occasion Sir John Johnstone had named to the council the failure of some irrigation of his from the supposed circumstance of the absence of mineral and earthy matter in the water, from the water being in fact too pure for the purpose.

Sir John Johnstone being thus appealed to replied, that, in the water to which Professor Way had alluded, there was no trace of lime whatever. The irrigation had been laid out by the late Dr. W. Smith on a thin moorland sandstone rock; there was no lime whatever.

Professor Way then proceeded to say, that, in Derbyshire, and at Bala Lake, in Wales, the water is exceedingly soft and pure, but considered unfit for irrigation. He felt no doubt that irrigation will become much more general than it has been; and the subject is more interesting at the present time on account of the Society's ensuing country meeting being about to be held in Devonshire, where irrigating operations have been so successfully carried out. He should, on that occasion, select specimens of the different waters, under different circumstances, for the purpose of analysis, in order that he might report, as requested by the chemical committee of the Society, the result of his enquiries on that interesting branch of his researches.

It has been found, by ascertaining from analysis the nutriment required by the hop plant, that only those soils that contained phosphate of lime and potassa, are suitable for the cultivation of that plant, namely, such soils as those on the green sandstone of Sussex, Kent, and Surrey; and that, what theory has thus prescribed as the condition, practice has actually proved to be the most advantageous in fact, the cultivation of hops having been most successfully carried out on the soils in question. He thought it would also be found, analogically, that successful irrigation will probably be found to be confined to certain districts; namely, principally to the limestone. He thought it might be a question how far the influence of that operation is due to the temperature of the water, or to its chemical composition, or to both; he himself considered the chemical nature of the water to be the most essential; at the same time, he was free to confess that we all had to learn on this subject, and he trusted that an inspection of the Devonshire meadows would lead to further enquiries on the important question connected with this subject.

III. WATER FOR CATTLE.

The Prof. commenced this third head of his lecture by remarking that he believed it is a generally observed fact, that cattle like the water of ponds, whilst they dislike that of limestone springs; that they prefer to quench their thirst in a green offensive collection of stagnant water, rather than in a running spring. In Bedfordshire he had seen cattle much relish a bad water filled with confervæ and animalculæ; which, however, was the only water to which they happened to have access. Farmers generally suppose that the cattle are fond of such water, on account of the green vegetable matter it contains; and a distinguished Professor has explained the fact by supposing such water to be "meat and drink" to the cattle. It is certain that they do not like hard water, and it gives a staring coat to horses when they are obliged to drink it; and, when it is considered that water in chalk districts contains from 60 to 70 grains of carbonate of lime to the gallon, whilst London water (which is hard compared to others) contains only from 15 to 16 grains, it will be obvious how much difference will be found to exist between different waters.

He regarded a good supply of water as essential to health, and thought it a point of importance to ascertain the kinds of water most suitable to the animal economy under different local circumstances. Professor Way concluded his lecture by expressing a hope that the members present would communicate to the meeting such cases of the practical effects of hard water on the health of cattle, as it had been his object, in the remarks he had then made, to elicit from them.

Sir JOHN JOHNSTONE enquired of Professor Sewell what results on the subject of water for cattle had become known to him at the Royal Veterinary College.

Professor SEWELL believed that cattle

generally preferred soft to hard water, and would drink from ponds and ditches rather than from springs. He thought the temperature had something to do with it, for he knew a brewer who had 100 horses, and who for 30 years had allowed them, whenever at home from hard work, to drink as much as they pleased of the New River water kept at a blood-heat; in consequence of which, the animals were maintained in perfect health and strength, having no spasmodic affections of the bowels, no chills, no staring coats.

Colonel CHALLONER had remarked that horses and cows preferred a pond into which dung-water had run.

The Earl of CHICHESTER had observed the same preference given for such water by cattle, but not to the same extent by sheep.

Dr. CALVERT had noticed that oxen preferred water in troughs to that in the clearest springs.

The Duke of RICHMOND remarked, that water given to race-horses in the stable, had always the chill taken off it.

Sir JOHN JOHNSTONE, in reverting to the subject of hardness, referred to the softening of water by boiling, as in the well known case of water for tea, and inquired whether the whole of the 15 or 16 degrees of hardness occasioned by the carbonate of lime was removed by that action.

Professor WAY stated that the deposition of the carbonate of lime did not take place at once on the application of heat.

Professor CLARK considered that 1½ or 2½ hours' boiling was required to effect that object.

The Rev. T CATOR referred to the use of soda for softening water, which Professor Way observed was adopted on account of its being cheaper than soap.

Mr. Raymond BARKER alluded to the effect of toasted bread in softening water. He had, a few days ago, an opportunity of witnessing a confirmation of what had been stated, of the predilection of cattle for impure water, by seeing them turn away from fresh water drawn for them out of a well, and seek the mud-water collected in little pools in the meadow where they were pastured. He believed that cattle were generally indisposed to drink hard pure water.

Mr. PUSEY, M.P., then favored the meeting with his views on the action of water in connection with the beneficial effects attending the irrigation of land. He doubted whether, in the present state of our knowledge, it could be admitted as a general axiom that hard water was good for irrigation, and soft water, on the contrary, prejudicial. In Devonshire, the criterion by which practical workers in water meadows were guided in the quality of the water most suited for their operations, was that of a certain warm, soft and oily sensation it communicated to the touch when a portion of it was held and examined in the palm of the hand; the absence of such a quality indicating, in their opinion, a water unsuited for irrigation. He knew, as a fact, that when lime existed in any water in such excess as to give it petrifying properties, such water was considered by practical men as decidedly unfit for irrigating purposes. He accordingly much doubted whether hard water was the only water fit for irrigation. He trusted that water meadows would not be confined to the limestone district: for in those geological districts in the west of England, where irrigation had been so long and successfully practised, lime was absent, and had to be brought on the land from other districts, as required for the purpose; the water being in consequence naturally soft. He considered that water in general became softened by remaining some time in ponds. In the hilly districts of Devonshire, the water of the small streams running down the declivities was found to improve in its irrigating properties. Again: it had been found that water running over peaty soil was prejudicial to it; but that the same water filtering through such land into the drains was advantageous to it, probly from carrying off the peaty matter; and by such percolation it became soft, and adapted for irrigation. He simply wished to express an opinion based on the facts which had from time to time come before him on this subject, that it would in the present state of their knowledge, be unsafe to assume the exclusive use of hard water in irrigation as an essential condition. In his paper on the Devonshire water-meadows, in the Society's Journal, he had only mentioned the prevailing opinion in that part of the country on this subject; he thought they were still ignorant on many important points in connection with the theory and practice of irrigation, and he trusted that the practical inspection of the catch and water-meadow of Sir Thomas Acland and Mr. George Turner, at the Exeter meeting, and the chemical analyses of the waters to be made by Professor Way, would tend to a more exact acquaintance with the principles and conditions of irrigation.

The Rev. Thomas CATOR considered that the soil itself had much to do with the results of irrigation.

Mr. ALMACK fully agreed with the opinions expressed both by Mr. Pusey and Professor Way. He thought that time would prove each of them to be correct in his views, when the particular conditions of each case were duly limited by further experience. He considered snow as the best exemplification of the beneficial action of water containing ammonia, and possessing chemical qualities from other impregnation, in addition to the influence exerted by its peculiar mechanical structure.

Mr. Fisher HOBBS was glad to find from Professor Way that this subject of the economical employment of water was to be pursued by him still further, especially in reference to points connected with agricultural operations. He did not think that animals generally preferred muddy to clear marly water from clean wells, although they might prefer it, after it had been drawn and stood some time, to the same water in its cold, fresh state as obtained immediately from the well. The cattle on one of his farms had so great a predilection for the drainage water from sand and gravel, that he was obliged to fence off the mouth of the drain whence the water issued in order to restrain them. He thought farmers ought not to allow the runnings from their farmyards to get into their ponds. He could fully confirm the views of Mr. Pusey. A curious circumstance had come within his observation in reference to drainage-water. He had cut a drain in his land 1 furlong in length, 8 to 12 feet in depth, through sand and gravel, and veins of clay, and which yielded 3 gallons of drainage water per minute. When the hot weather set in, a most noxious odor proceeded from this drain, and there was found, on examination, an accumulation of several cart-loads of a congealed gelatinous-looking matter of an ochreous color, and in substance resembling fresh animal liver. On revisiting the place a fortnight ago, the whole mass of corruption had vanished, and only a few insects were to be found in its place.

Mr. ROWLANDSON made some observations on the soap-test process of Professor Clark. He thought it a very simple and useful test for the hardness of water in all cases excepting when (as in the water of the Dolomitic districts) the bicarbonate of magnesia was present; whenever the hardness arose from magnesia, he believed the soap-test would fail to indicate its degree, or rather, it would give a false indication of its amount; which might mislead, unless other tests were conjoined with the soap-test, for the purpose of guarding against this occurrence.

Professor WAY was aware that Professor Clark's test applied only to certain waters; it was useful from its generally applicable and simple mode of employment; at the same time, he agreed with Mr. Rowlandson that, in cases where magnesia was suspected, it would be desirable to employ a collateral test, although the indication of hardness given by the soap-test with magnesian waters would at once, by its unusual amount, show the disturbance occasioned by the presence of some other salt than carbonate and sulphate of lime. With regard to the questions affecting the action of water in irrigation, he had only to repeat his diffidence on the subject, although he thought the criterion of hardness by which the Devonshire makers of water-meadows were guided might be fallacious, and that hard water might produce a soft oily feeling on the hand as well as soft water. He had himself formed the opinion that the effects resulting from irrigation were due more to the chemical qualities of the water than to the circumstance of its higher or lower temperature; but he was sensible how ignorant we are on these difficult questions, and he should be most open to conviction, and glad to learn all that he could on the interesting subjects to which he had then had the pleasure of calling the attention of the members.

On the motion of the Earl of CHICHESTER, seconded by the Earl of LONSDALE, the best thanks of the meeting were then voted to Professor WAY for his kindness in delivering before the members so interesting a lecture on that occasion.

ABSTRACTS OF SPECIFICATIONS OF CHEMICAL PATENTS RECENTLY ENROLLED.*

Improvements in galvanic batteries, in electric telegraphs, and in electro-magnetic and magneto-electric machines. ISAAC LEWIS PULVERMACHER, Vienna. Sealed December 15th, 1849.

Claims.—I. Making galvanic batteries to revolve.

II. In respect to galvanic batteries, the use of half porous and half-glazed diaphragms, a rotative action by which the plates or electrometers are dipped into or lifted out of the acids (more or less) at pleasure, a mode of entirely emptying the apparatus of the nitric acid when requisite; a hollow axis or axes, pipe and reservoir, by which the nitrous fumes are carried off and collected, and certain electro-magnets

*Collected from *The Mechanics' Magazine.*

and parts in immediate connection therewith, whereby the electric current is maintained at nearly one uniform strength, and apparatus for increasing or diminishing the resistance to be overcome by such revolving batteries.

III. Certain modifications of the revolving galvanic battery.

IV. A revolving battery, in so far as regards the employment of three fluids, of which one (the concentrated sulphuric acid) is used to prevent the two others (the nitric acid and the dilute sulphuric acid) from mixing, and the arrangements by which such separation is effected; and also certain modifications of the said three-fluid battery.

V. A self-supplying revolving battery, and a modification thereof, in so far as regards certain mechanical arrangements by which the expansion or reduction of the strength of the current generated by the battery is made to be itself the means of obtaining a fresh supply of the necessary elements.

VI. The employment in galvanic batteries of diaphragms and cones composed of graphite, made plastic by pulverisation and mixture with bituminous substances; also a particular form of graphite diaphragm, and a diaphragm composed partly of plastic graphite and partly of glass or porcelain.

VII. Certain hydro-voltaic chain batteries, in so far as regards the arrangement by which every link is made to constitute of itself a separate and distinct battery, having a positive and negative electro-motor; and also the combination therewith of moderators and indicators.

VIII. Three several modes of changing the direction of electric currents; that is to say, *firstly*—The regulation of the changes of the poles in such manner that, between each change and that which follows next, the power of the current shall gradually increase from a minimum to a maximum, and then gradually decline from a maximum to a minimum, at which last point alone the change takes place; *secondly*—The producing of the changes in two or more parts of magnetic conductors, by means of a single apparatus, and in such manner that, whilst the current in one conductor is gradually increasing in power, that in the other is gradually diminishing, and the change of direction is produced at the moment when the diminishing current attains its minimum; and, *thirdly*—The mode of producing the change of power by either gradually increasing the surfaces of the electro-motors in the case of moveable batteries, or by the successive introduction (in the case of stationary batteries) into the electric currents of resisting bodies.

IX. An electro-magnetic arrangement for the production of mechanical power; that is to say, in so far as regards the combination of a single galvanic battery with two cylinders covered with electro-magnets, and the enveloping or connecting these magnets, the whole or part of them, by coils of conducting wires, and the other parts in immediate and necessary connection therewith; also a modification of the said arrangement wherein three or more cylinders, covered with electro-magnets as aforesaid, are used instead of two.

X. A governor, for regulating the degrees of immersion of the electro-motors into the exciting fluids.

XI. An electro-magnetic motive engine, in the general arrangement and construction of parts of which the same consists, and more especially in respect of a method by which a continuous and unintermittent action is produced from two sets of electro-magnets, and the necessity for a fly-wheel thus dispensed with.

XII. A magneto-electric rotary engine; also a modification thereof, wherein three flat plates are employed as the magnets.

XIII. Certain improvements in electric telegraphs; that is to say, in so far as regards, *firstly*—A method of varying in intensity of the current, either by increasing or diminishing the number of elements employed, or by interposing more or less powerful resistants to the current; *secondly*—The imprinting letters or signs by one complement of the current; *thirdly*—The substitution of a letter cylinder for the letter wheel ordinarily employed, and a method of arranging the letters and signs on such cylinder; *fourthly*—The application of double escapements, each capable of assuming four directions, and each producing effects different from those produced by the others; *fifthly*—The employment of four electro-magnets to act on two soft iron bars, and thereby render a weak galvanic current available in two directions, and productive of two separate and distinct effects; and, *sixthly*—The method of gradually detaching the keeper from the electro-magnet, by causing the springs which act upon the keeper to come only successively into operation.

XIV. A flat arrangement of electro-magnets.

Improvements in the manufacture and refining of sugar. WILLIAM BIRKMYRE, Fulbeck Cottage, Hampstead. Sealed December 12th, 1849.

The object of this invention is chiefly to render insoluble the coloring matter of cane-juice and syrups of raw sugar, by precipi-

tating in these liquids a small quantity of alumina by lime, chalk, or limestone either from sulphate of alumina or from sulphate of alumina and silica, or silex (this last-named compound being the product of the action of sulphuric acid and heat upon China or pipe clays).

This compound of sulphuric acid, alumina, and silex is obtained by adding an equal weight of sulphuric acid—if it be of sp. gr. 1·847—to dry china or pipe clay, either of which consisting almost entirely of alumina and silex, and then heating the mixture to about 700° F., when every 100 parts of the dry, common, China clay of commerce become 175 parts. In this way the sulphuric acid and the alumina form a salt, which is as near as possible a sulphate of alumina with free silex; in some parts of this country the above compound can be made for less than £4 per ton, and whilst it contains no soluble substance that is not precipitated by lime or chalk, it has the further advantage of yielding double the quantity of alumina to be found in the alum of commerce.

The patentee states, that the best mode of applying to cane-juice and syrups of raw sugar the sulphate of alumina, either by itself or with silex, is as follows :—

Clarifying and decoloring cane-juice.—To every 100 gallons of unskimmed concentrated cane-juice, previously treated either with or without lime (temper) of the density of 1·200, or 40° of Twaddell's hydrometer, and of the ordinary color, there should be added, by degrees, 25lbs. of a mixture consisting of 14lbs. ground sulphate of alumina and silex, and 11lbs. ground chalk. Upon the addition of these bodies, there immediately ensues an effervescence from the escape of carbonic acid, and simultaneously with it a precipitate of alumina with the coloring matter. After boiling for a few minutes, the whole contents of the pan ought to be passed through bag filters of the construction well known in this country by the name of Schrœder's filters. The purified juice should now be concentrated either in an open or the vacuum pan; if the former pan be used, the juice should be brought up to the temperature 239° F., and struck at once into cones of iron or earthenware capable of holding about 60lbs. of the juice. On standing twenty-four hours, they should be once liquored with strong syrup. By proceeding thus, the sugar is obtained of a good color, and cured in much less time than by the ordinary process of making Lisbon sugar in the Brazils or Cuba, and the serious loss of 10 per cent. saccharine matter, by drainage and fermentation on ship-board from British colonies completely avoided. As more than half the coloring matter has been abstracted from the juice by the alumina, whilst the filtration has withdrawn all the insoluble matter, a sugar is produced which gives a clear solution, and is free from the sediment which appears in dissolving ordinary Muscovadoes.

The sediment in the bags should be washed, first with weak but hot juice, and then with water. The washed sediment (consisting of alumina with coloring matter and other impurities of the cane-juice, sulphate of lime and silex, with a small excess of chalk) may be used as a fertilizer, or converted by heat into a sort of charcoal, fit for decoloring cane-juice or syrups.

When the pure sulphate of alumina is used, 11lbs. of finely ground chalk should be thrown into the 100 imperial gallons of concentrated cane-juice, alternately with 9lbs. of sulphate of alumina, either in powder or in solution. The sulphate of alumina and chalk in the above proportions are equally as powerful as the mixture of 25lbs. of sulphate of alumina, silex, and chalk.

Refining Raw Sugar.—For every cwt. of Muscovado sugar dissolved in the clarifiers (blow-ups,) there is to be added by degrees, and alternately, 2lbs. of finely ground chalk, and the like quantity of sulphate of alumina, to the hot syrup of the usual strength of 27° saccharometer, or 47½° of Twaddell's hydrometer. As the sulphate of alumina is very soluble in water, it may be more convenient in some instances to add it in solution; for this purpose it should be dissolved in an adjoining vessel, and every gallon of the solution of specific gravity 1·150 or 30° Twaddell's hydrometer, contains almost exactly 2lbs. of sulphate of alumina. This syrup should be brought near to the boiling point, and kept thereat for a few minutes, and if steam be the heating agent of the clarifiers, the apparent boiling point of 203° F., produced by high-pressure steam will be quite high enough. The steam is now to be turned off, and the whole contents allowed to settle for a few minutes, after which they should be passed into the bag filters. The filtered liquor may now be passed into the charcoal cistern, or at once evaporated in an open or vacuum pan, then crystallised, poured into moulds, brushed off, and syruped in the usual way. When as much as possible of the strong syrup has gone through the filters, they should be washed by passing boiling hot water through them, and the weak syrup pumped into the clarifier for dissolving more sugar. In this way it is found that the alumina completely dispen-

ses with blood (spice), and at the same time, abstracts from the sugar at least one half of the coloring matter, and thereby dispenses with one-half of the animal charcoal. If no blood nor animal charcoal be used, the refined sugar produced from raw sugar, and that from cane-juice in the mode just described, retain an agreeable smell.

The process of manufacturing and refining sugar, which has been described, may be varied by using lime alone with sulphate of alumina in the syrups, or by using various proportions of lime with chalk or limestone.

Claims.—I. The decoloring of cane-juice and syrups of raw sugar by adding to them a mixture of pounded chalk or limestone, and the substance (sulphate of alumina and silex) derived from the action of sulphuric acid and heat on China and pipe clays.

II. The decoloring of cane-juice and syrups of raw sugar by precipitating alumina in the cane-juice and syrups, from sulphate of alumina by lime, or ground chalk, or limestone, or by a mixture of lime with chalk or limestone.

III. The use of the substance formed in the cane-juice, or of raw sugar syrups, by the action of lime, chalk or limestone on sulphate of alumina and silex; or of lime, chalk or limestone on sulphate of alumina without the silex.

Improvement in photography. WILLIAM HENRY FOX TALBOT, Haycock Abbey, Esq., and THOMAS AUGUSTINE MALONE, Regent Street, Photographer. Sealed December 19th, 1849.

Mr. Talbot claims under this patent:—

I. The use of unglazed slabs of porcelain to receive photographic images. These slabs are to be composed of the best materials—thin and semi-transparent; and when requisite, they may be strengthened by being cemented to a slab of glass. The porcelain is coated with a thin film of white of egg, then dried, and immersed in a solution of nitrate of silver (25 grains to 1 oz. of water,) dried again, and plunged into a solution of iodide of potassium (25 grains to 1 oz. of water.) When the plates are required for use, they are treated with a "gallo-nitrate solution," and placed in the camera; after which, the image is fixed by washing the slab with water, bromide of potassium, or hyposulphite of soda, and lastly with water.

II. Converting negative photographic images into positive ones by the following means:—A slab of glass coated with a thin film of white of egg or albumen, is dipped into a solution of nitrate of silver (15 grains to 1 oz. of water.) It is then excited by being brushed over with a saturated solution of gallic acid, and placed in the camera; after which the image is treated with a solution of nitrate of silver (30 grains to 1 oz. of water,) and washed with water, bromide of potassium and water.

III. The employment of varnished paper instead of glass, to receive photographic images. The paper is coated with a thin film of white of egg or albumen, and subsequently treated in the same manner as has been before directed with respect to ordinary paper or porcelain.

IV. Obtaining a better fixation than has yet been practicable by immersing the paper in a boiling solution of caustic potassa.

The color of the image is changed into a sepia tint by exposing it to the vapor of sulphuretted hydrogen.

V. Covering steel plates for engraving purposes with a thin coating of albumen, and treating them by the process before described for fixing the image.

Improvements in printing and dying fabrics of cotton and other fibrous material. THOMAS LIGHTFOOT, Broad Oak, Accrington, Lancaster, Chemist. Sealed January 3rd, 1850.

I. The fabrics are to be partially bleached by boiling from five to seven hours in water, with 2 oz. crystalized carbonate to each pound of fibre. It is next washed, dried, and steeped in sulphuric acid mixed with water of the strength of 1° Twaddell's hydrometer, then washed and dried again, after which the fibres are immersed in a mixture composed of ½ oz pearlash and 1¼ pint of water at the temperature of 1° F., and 2 ozs. of olive oil (to each 1lb. of fibre,) until absorption takes place. They are subsequently dried in a stove, and subjected twice to the first operation, and dried again. They are then made to absorb clean water at 110° Fahr., to the extent of 1½ pint for each 1lb. of fibre. These two operations (absorption and drying) are each repeated alternately eight times, after which the fibres are steeped or padded in a solution of 1½oz. of pearlash to 4 pints of water, dried and saturated with acetate of alumina. This mordant is fixed by washing, after which the fibres are ready to receive the color.

Instead of the preceding process, the patentee states that the same result may be obtained by saturating the fibres with a solution of any of the metallic bases, such as salts of magnesia, tin, copper, nickel, or cobalt; or with a solution of an alkali, or an alkaline solution of a metallic oxide, such as aluminate of soda, or aluminate of

oxide of tin in a solution of lime, potassa, &c. The orchil or cudbear red for printing by mixing it with negal, and is applied to the fabric, ubsequently steamed in the usual man- The fabric when composed of vege- e fibres entirely, may be subjected, after s woven, to the preparatory process; but composed of vegetable and animal fibres ombined, the vegetable fibres must be prepared by themselves previously to weaving them with the others. When orchil or cudbear alone is used, then the color is brightened by passing the fabric through an alkaline solution; but when other colors are used, which would be injured by the alkali, those portions of the fabric on which the orchil or cudbear has been printed, are printed over with an alkaline solution, thickened to the required consistence. Or 24 ozs. of hydrate of magnesia, or 12 ozs. of calcined magnesia may be mixed with 1 gallon of color before printing.

II. The improvement in dyeing vegetable fibres consists in preparing them by either of the processes before described, and dyeing them with orchil or cudbear, in the same manner as wool or silk has hitherto been dyed with the same color.

Claims.—I. Printing orchil or cudbear on fabrics composed wholly or partially of cotton, linen, or other vegetable fibres, prepared in the manner before described, and also the use of magnesia combined with orchil or cudbear.

II. Dyeing vegetable fibres prepared as described, with orchil or cudbear.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

THE PHARMACEUTICAL SOCIETY.

A MEMORIAL is about to be presented to the Council of the Pharmaceutical Society praying that in consequence of Mr. Bell's Journal having become an instrument for the promotion of the private interests of a few individuals, to the disgrace of the Society, and to the injury of the great body of members, that they (the Council) will be pleased to take into their consideration the necessity of abolishing Mr. Bell's monopoly, and publishing the transactions in a form more creditable to the character of the Society.

The memorial has been numerously signed by the chemists at the West end. It is to be regretted that the originators of the memorial are at present unable from a pressure of time to give the members residing in other localities an opportunity of expressing their opinions by signing it. We understand that the reasons that a few gave for not signing it were ludicrous, and, in some instances, disgraceful. One would not sign it, although he had left the society in disgust, because he knew Mr. Bell's partner. Another would not sign it because Mr. Bell had made him an auditor, and had promised to place him in the Council next year. We are not at all surprised at this last reason, for it is well known that Mr. Bell and one or two of his colleagues have for years usurped the rights of the electoral body. No man can become a member of the Council unless he is the nominee and willing instrument of these worthies. Others had private reasons for not signing the memorial. We can only regret that they should have been offered the opportunity, for the memorial would have been degraded by their names being attached to it. All we contend for is a fair field and no favoritism. Let every Journal stand or fall according to its intrinsic merits. The only matter that surprises us is, that the members should have tolerated the existence of this monopoly for so many years. There is scarcely one who cannot trace unmistakeably some deep injury to his business through the instrumentality of the Journal. It has great weight in making the few and damaging the many in their prospects by a belief

prevalent amongst medical men that the Society endorses with its authority and approbation all the opinions and dicta of Mr. Jacob Bell.

We are not at all surprised that the Liverpool chemists should be deceived by the specious plausibilities of Messrs. Bell and Morson. But as men of the world it is to be wondered at that they did not stop to inquire before they gave a vote of confidence, what were the motives that induced these gentlemen to pay them a visit at the cost of so much time and expence. The visit to Liverpool was a sort of political dodge to obtain that which Messrs. Bell and Morson knew it was impossible to receive in London—the principal scene of their labors.

When we tell our Liverpool friends that there is the greatest aversion felt amongst the chemists of London to the proceedings of these persons, which will probably in a short time form the subject of a public inquiry at a special meeting of the Pharmaceutical Society, they will not be astonished at their endeavors to win good opinion at any price. The Pharmaceutical Journal has long been a grievance from causes which provincial chemists, from being partly beyond the influence of their sphere of action, can scarcely adequately estimate. The secret of Mr. Morson's support to Mr. Bell to enable him to maintain the monopoly of his Journal will be apparent when it is shown that Mr. Morson is interested in upholding abuses which could not exist for one hour were Bell's Journal independent of the Society. There has been upwards of £2,000 paid by the pupils of the laboratory during these last five years. This sum has never been accounted for in the annual financial balance sheet of the Society, although incidentally mentioned in the last report, for reasons that will be shortly evident. When the names of the persons who have received a large portion of this money come before the public, Mr. Morson's desire for suppressing information concerning this abuse will be clearly understood. It cannot be a matter of amazement that Messrs. Morson and Bellshould be hand-in-glove, for they, far above all other members, including the Council, have the greatest stake at issue in preventing inquiry, and for keeping the Journal and other abuses in *statu quo*.

If any one doubts the accuracy of our statement respecting this money transaction let him apply to the auditors of the past year. Let him inquire of Messrs. Hawxby and Wyman who did sign the account in their capacity of auditors, or to Mr. Alex. Hemingway, who refused to do so in consequence of this strange omission. Further let him apply to Mr. Squire for the remonstrance addressed to him by these gentlemen concerning the condition of the monetary affairs of the Society.

From a mistaken delicacy, or a want of penetration, the auditors for the five preceding years have certainly failed to perform their duty, therefore the greatest possible credit belongs to Mr. Hemingway* for the independence and judgement he has exhibited by endeavoring to put a stop to such proceedings. The gratitude of every member is due to him for such spirited conduct. He cannot be surprised after this courageous deed that he was black-balled as a candidate for the Council through the undue power and influence of those who regard his skill in detecting an abuse, and his determination to expose one, as death to their schemes and hopes. Doubtless to the same causes Mr. Wyman is indebted for his non-election. But let these gentlemen remain true to their colors and avoid any compromise with the enemy, and the members of the Society will awaken from their apathy before the next annual election and gladly secure their services on the Council.

In justice to those members of the Council who assiduously labor in behalf of the Society without any canting professions of disinterestedness, and who do not apportion to themselves any of its good things, we deem it right to mention that they are deeply impressed with the necessity of remedying these notorious evils. In fact these matters have been already discussed at the Council board, but from a reluctance to directly censure or oppose those persons with whom they have been familiarly associated for some years, no decisive measures have been adopted by them to suppress the abuses above alluded to. We are informed that one of the most influential members

* Did we allow personal feelings to sway our judgement we should not have paid the above tribute to Mr. Hemingway, for we have heard from several quarters that he, when soliciting our friends for signatures to the memorial, has disavowed any connection or sympathy with the views of "THE CHEMIST," on the subject of the memorial, and asserted that he was the sole originator thereof. As it seems to be a great gratification to his vanity to be considered so great a hero as the originator of a memorial he is welcome to the honor so far as we are concerned, but we cannot admire the moral constitution of any man who holds with the hare and hunts with the hounds, as he is doing in this case.

of the Society, Mr. John Savory, has retired from the Council disgusted with the proceedings of a factious minority.

TO MR. JACOB BELL.

"Rem facias; rem, si possis, recte, si non, quocunque modo rem."

SIR—

After much elaborate research through the writings of the ancients to obtain an appropriate motto for your Journal, I have discovered the above sentence—pregnant with meaning, and if it had been manufactured to order, it could not have been more suitable. I should advise you to obtain a translation of it, from the first pupil that comes before the Pharmaceutical board for examination, and you will at once discover its extreme value as a motto for the Journal and as an introduction to this letter.

As you are the self-appointed apostle and champion of the abuses perpetrated in the name of the Pharmaceutical Society "by a few members upon whom devolves the chief labor of managing its affairs," as you stated with much satisfaction in your speech at Liverpool, in June last, I beg to call your attention to a few more "*scurrilous*" figures and "*cowardly*" facts, so that you may again receive the balm of a vote of confidence for your injured feelings, whenever you may think proper to convene a sympathising meeting for that purpose: a farce which but few so thoroughly understand the machinery of getting up as yourself.

Your power of appeasing dissatisfaction is unquestionably great; but you know—or will have to learn—that there are some men who will not sell their birthright for a mess of pottage. You may affect to despise these men, and treat their grievances as calumnies; but before long you will discover, to your chagrin, the false estimate you have formed of their power and determination. Their cause is slowly, but, nevertheless, surely, progressing to a successful issue. Their name is legion, and at their approach a band stronger—with a greater stake in danger—than yours would melt away and vanish.

I will now bring before you the statistics and financial career of your Society, and await to learn by what declamatory phraseology you will attempt to burke this inquiry; but I promise you and your confidants that you shall have a committee of inquiry to ascertain who has received the princely funds of the Society, and for what purpose.

As a proof of the progress that Society has made under the fostering care "of the staunch supporters who have put their shoulders to the wheel," I will quote the lists of members and associates, and the annual income of the Society, as furnished by the annual report:—

Members and Associates.		Income of the Society, exclusive of lecture fees.			
1841	934	1841	£1944	11	0
1842	3957	1842	6269	16	4
1843	3629	1843	6231	13	11
1844	3112	1844	5563	12	6
1845	2942	1845	2251	13	6
1846	2705	1846	3019	18	9
1847	2295	1847	2993	8	0
1848	2264	1848	2471	15	3
1849	2033	1849	2657	4	11
		Total	£33403	14	2

By comparing the numbers of members and associates for the years 1842 and 1849, it will be at once seen that upwards of 1900 persons have seceded from the Society—a more damning proof than any language that could be used, of the estimation which these men have formed of your labors. Could you but read the hearts of the existing members, you would discover that their adherence to the Society arises not from any benefit that it at present confers, but from a hope that it may become an instrument of usefulness when its councils are more wisely directed.

I now exhibit the cost of your journal, and its delivery, in consecutive years to the Society:—

	£	s.	d.
1841	153	15	0
1842	1293	15	3
1843	1293	1	2
1844	1247	2	4
1845	1001	11	3
1846	936	15	8
1847	826	10	0
1848	828	13	10
1849	826	14	0
Total.....	£8347	18	6

Were your profit of this sum all you had received from your connection with the Society, you might have enjoyed it unmolested till doomsday, and ridden your hobby to death at the expense of the members; but since it has been the most successful method of advertising your drug emporium ever devised, those whose loss is your gain will not tolerate longer that they shall pay you for puffing yourself. You can keep a poet, as Moses does, for the future, and be welcome to the advantages accruing therefrom; but you shall no more desecrate the Pharmaceutical Society by

turning it into an advertisement office.

You have rendered the Pharmaceutical school a charitable institution, where those who can afford to pay for their professional education, as well as the members are able to pay for them, get their education at less than a quarter of its cost. In proof of this statement, I will quote the total sum paid to the lecturers, and the fees paid by your pauper pupils for attendance at the lectures.

	£	s.	d.
Total sum paid to lecturers	4515	19	8
Total fees paid by pupils for lectures.....	1002	14	0
Difference.....£3513		5	8

In searching through the yearly financial reports, to ascertain therefrom the cost of the laboratory and the fees paid by the laboratory pupils, to complete my statement as regards the expense of the school, I have discovered an evidence of a sample of "cooking accounts," worthy of the ingenuity of a Railway King. I find that, whilst credit is given in the annual balance-sheet for the fees paid by the lecture pupils, there is no credit given in any shape for the fees received from the laboratory pupils, and no account rendered of what has become of this money. No member of the Society ought to rest quiet until the most ample explanations respecting this suspicious affair have been given Did you hope by this omission to elude investigation as to where this sum has travelled? If so, you have been too credulous for once. The sum received from the laboratory pupils amounts, according to a statement which is not verified by the auditors, to no less than £2149. 3s. I will here show the total expense of the Pharmaceutical school above the fees paid, assuming that the £2149. 3s. has been properly expended, of which there is not the slightest evidence.

Expence of laboratory and apparatus	£2797	14	6
Add difference of lectures	3513	5	8
Total expenditure for school above receipts from pupils of both classes	6311	0	2

I cannot believe that a man of your reputed sense of honor and integrity can be a willing co-operator in this system of accounts. There is this excuse for you, that you cannot take an independent course whilst you have an abuse in the shape of a Journal to maintain. You have not even the excuse of limited means for supporting that which you may consider a vested interest in supplying the Journal to the Society. Come forth, then, from this mire, and fight not step by step a battle which must end eventually in a total defeat.

In conclusion I would ask you to give a direct answer to these questions. 1st, Is it not a violation of the charter for only two auditors to sign the financial report? 2nd, Did not one or more of the auditors refuse to pass the last year's accounts because they bore evidence of being unfairly rendered? 3rd, Did not the finance committee refuse to pass the account of a certain member of the council for chemicals supplied to the Society because it afforded indisputable proof of unjust charges? 4th, Do you think it creditable for a man as a member of the council to order goods from himself for the use of the Society?

Yours, &c.,

SCRUTATOR.

SANITARY NOTES.

NO. VIII.

The Report of the General Board of Health on the supply of Water to the Metropolis, is a document so full of matter of great economical and sanitary importance, with much of considerable novelty, or the enunciation of new ideas and plans, and much of placing in their true lights many well known facts, and at the same time it is of such length, viz 324 octavo pages, that probably the most acceptable plan of review will be to attempt to condense the subject matter, and thus place before the reader in a short space, the chief points of a Report, undoubtedly of great value, drawn up by a masterly hand. If there are errors in the deductions drawn from facts, it is perfectly obvious that they are errors of conviction. There is much food for investigation given to Chemists; and also much Engineering matter which will doubtless be energetically criticised by the numerous parties concerned in the "conclusions" to which the Board have come.

The Report is drawn up in five divisions. First.—As to the sources, quantities and qualities of water at present supplied or proposed to be supplied, and as to the best available sources of supply.

Secondly.—As to the mode of distribution now adopted, and as to the influence of the

mode of distribution upon the quantity of water required for the Metropolis.

Thirdly.—As to the mode of removing water after it has been used and discharged, especially as regards the damp and low-lying districts of the Metropolis.

Fourthly.—As to the advantages of a system of constant supply for surface cleansing, diminution of risk from fire, and new applications of water as a source of power.

Fifthly.—As to the advantages in economy and efficiency of combined works for water supply and drainage, over the present system of independent works for these purposes, and as to the best administrative machinery for carrying out such a system of combined works, p. 3.

First.—As to the sources, quantities and qualities of water. Tables of statistics of the present Water Companies are given, showing the Districts supplied,—the sources of their supplies,—populations of towns and villages draining into the rivers above the points of supply—the positions of the reservoirs,—the number of houses supplied, the gross daily supply for all purposes, viz, to private houses, to large consumers, for road watering, for flushing, &c, and for fires,—and the daily delivery calculated as per house for each of the last mentioned purposes.—It results from these tables that the Companies supply 270,581 houses, and as there are under the income-tax-assessments about 288,037 houses altogether, it would appear that there are about 17,456 houses, or about 6 per cent of the whole, unsupplied with water.—Where house to house enquiries have been made for Sanitary purposes in densely populated districts, upwards of 18 per cent of the houses have been found to be unsupplied with pipe water; but in other large parishes and districts only 5, 4 and 3 per cent.—There are, however, returned by the Companies 1,181 cases of supply by stand pipes, which each serve for several houses, and often for a whole court or alley.—p. 8: This, to the Commissioners, sufficiently explains the discrepancy; but it remains a great contrast to the calculations made last year that there were 70,000 houses unsupplied with pipe water. The gross daily quantity of water pumped into the metropolis amounts to 44 million gallons. This quantity would be delivered in 24 hours by a brook 9 feet wide and 3 feet deep, running at the rate of 3 feet per second, or little more than 2 miles per hour. The total weight of the annual supply is nearly 72 million tons; and the cost of raising this weight 100 feet high would be about £9000 per annum.—p. 10.

The Report then notices the different plans for procuring additional supplies of water, from the Thames, the Colne, the Verulam, the Lea, the Darenth, the Mole, the deep Chalk at Watford, and the upper Chalk of North Kent, all of which plans are rejected for two reasons, first a *larger* supply is not wanted but a better one, and secondly though several of the above plans would bring better water than is to be had at present, yet none of them would bring the best that is to be found.

In the commencement of the investigation the Commissioners found a difficulty in the conflicting character of the evidence produced.—On one side came water consumers with bitter complaints of the wretched water supplied to them, and producing specimens of the water, dark and foul, and abounding in visible animalculæ.—On the other side were the officers of the Water Companies with specimens from the reservoirs of "unexampled excellence," and backing themselves with analyses of eminent chemists.—In respect to the first viz, the consumers, the oft repeated evidence was again given not only by consumers, but by resident surgeons and medical inspectors, of the offensive and dangerous character of the water in many districts. This description of facts has been so often alluded to and is so well known that it needs not now to be again particularly described.—Rotherhithe, Lambeth and Bermondsey afford fearful illustrations of the danger of drinking bad water.—In respect to the second evidence, viz that of the Companies, a large question is opened, viz the changes that take place under various circumstances in water which

originally contains the seeds of impurities.

"Whatever noxious ingredients there may be in common air, there is reason to believe that they are for the most part capable of being absorbed by the water aërated with it; but the direct proof of the injurious action of the impure air of large towns upon the water exposed to it, is difficult."—p. 17.

Dr. Gavin says, "when water is taken into the close-heated and offensive rooms of the poor, it rapidly absorbs the offensive gases, &c., and becomes tainted, and when the water has been preserved some time in butts or tubs outside, exposed to the fœtid air of a neighboring privy it taints still more rapidly."—p. 30. In this extreme case the effect is certain, it remains to be proved to what extent it acts generally.

"The Companies' specimens impartially considered are usually but second rate, nevertheless it has been deemed important to endeavor to distinguish the qualities that are essential, from those that are adventitious, to the chief sources of supply."—p. 30. And consequently the Commissioners directed Dr. Angus Smith to investigate and report on the nature of Thames water from its source downwards. "This he has done carefully with all the aid which chemistry in its present state is capable of affording. But as yet chemistry has failed to determine the qualities of much animal and vegetable and above all gaseous matter that is perceptible and offensive both to the taste and to the smell."—p. 31.

"The clear water taken above Richmond is not disagreeable to the taste, but it becomes after stagnation in the air of the Green Park vapid, and when kept in a close room, very soon, positively fœtid, and effects are produced from drinking it which are not accounted for by any quantitative analysis. These effects are, probably to be ascribed to the absorption by the water of noxious matters held in suspension in the air, but chemistry has not yet, by analysis of the common air, detected the most potent causes that affect injuriously the public health."—p. 31.

Professor Hoffman says—"It cannot be denied that the air in the close courts and alleys in a densely-peopled town district, produces effects upon the organism which are not observed, e.g., in a mountainous country. These effects may, to a very considerable extent, be due to the difference in the physical and mechanical condition, state of motion, rapidity of change, &c., of the two kinds of air in question; nevertheless, part of these effects must, I believe, be ascribed to the presence of certain constituents which the air contains, in addition to its usual components. These constituents must be present, however, in exceedingly small quantity, for chemistry has not, up to the present moment, succeeded in isolating these substances, or characterizing them by particular re-actions.—As yet, in the air only, the presence of oxygen, nitrogen, aqueous vapor, carbonic acid, and ammonia, has been accurately established, but it has been proved that occasionally other substances must exist in the atmosphere; for on passing the air of certain localities through concentrated sulphuric acid, the acid is found to have become black, an effect which is not produced by any of the constituents mentioned above.—Thus the presence of substances other than those enumerated is indicated only by their action upon the organism and upon sulphuric acid, but we are unable to say whether both kinds of atmospheric constituents are the same."—p. 32.

The aëration of water or the power of water to absorb gases from the air is considered to be a matter of the highest importance and one which is but ill understood. Another quality of water to which too little attention is paid is its coolness.

Evidence is given that the quality of coolness is found to be of so much value, as to induce brewers and other large consumers to incur considerable expense to obtain it. For sanitary purposes also the quality of coolness is of very great importance; particularly with reference to the reception and removal of refuse, cold impeding and even arresting decomposition. p. 37. —When water is kept stagnant and ex-

posed to the light and heat of the sun in moderate temperatures, vegetable infusoria of the class called algæ, and also fungoid vegetation, appear rapidly.—Many tribes of these vegetable productions appear to die with great rapidity sometimes in one or two days and then decompose. Immediately after these, animalcular life appears. Light and heat also increase the mineral impurities of waters by the increased evaporation, and consequent leaving of a larger proportion of mineral matter as a residuum. p. 38.

The results of Dr. Angus Smith's examination of Thames waters are then given. —"As the quantity of chlorine, chiefly as common salt, is a constant accompaniment of organic impurity, there being between common salt and animal life a necessary intimacy, I will give here the rate of increase from Pangbourne down to London Bridge :—

		Grains of chlorine	Grains of common salt
Half ebb.	Pangbourne	·172	·287
	Windsor .., ...	·209	·349
	Richmond.	·184	·307
	Hammersmith ..	·184	·307
	Chelsea	·283	·472
	Lambeth	·481	·801
	London Bridge .	·494	·824
	Lambeth (High Water) ...	·753	1·256

This increase agrees with the increase of organic matter and of organic life got by microscopic observation." p. 39.

In Richmond and Hammersmith water a quantity of brown flocculent matter fell to the bottom of the vessel, containing animalcules in great abundance. They contained also phosphates and silica. The river water opposite the water works at Chelsea contained :—

	Grains in a gallon.
Of inorganic matter	23·10
Of organic matter	4· 2
	27·12
At another time	
Inorganic matter	19·16
Organic	2·58
	21·74

and a greater number of animalcules than at Hammersmith, and the same brown flocculent deposit.

The water opposite Lambeth Palace did not become clear after long standing, containing a fine clay, not dissolved by acids. When burnt, there is a strong acid smell, and there is also nitric acid perceptible in the remaining salt.

Water obtained at Hungerford Market had :—

	Grains in a gallon.
Inorganic matter	47·55
Volatile and organic	13· 7
In suspension	61·25

The organic matter burnt, had the smell of rotten wood. A specimen procured between Blackfriars and Southwark Bridges, near the London side :—

	Grains in a gallon.
Inorganic matter in suspension	43·12
Volatile and organic	13·12
	56·24

This specimen gave a smell like burning wood also, when boiled down and heated.

Both specimens last mentioned contained animalcules larger, fatter and uglier than any preceding.

The Report states that the tenor of the scientific investigations of Dr. A. Smith and Dr. Hassall is to confirm the popular impressions derived from sight and taste as to the nature and quality of the supplies delivered ; [p. 42,] and also that even where filtration is used by the Companies, it affects only a portion of the impurities.

It is obvious that the poorer classes in the metropolis cannot be blamed for their avoidance of water as a beverage :—indeed it is hardly desirable that they should drink the water at present within their reach. From a town population being lower in general health than a rural population, from having amongst them a larger proportion of weakly, sickly and susceptible persons, the health of a town is more powerfully affected than that of a rural district by inferior qualities of the common beverage. Towns are at present never free from epidemics; and in epidemics when the general health is more than ordinarily depressed

the effects of impurities in water are strongly marked. This was strikingly exemplified during the last epidemic, when effects of variations on the quality of water became visible that were observable or observed at no other time. p. 46.

The subject of the "hardness" of water and its effect on the general health is fully discussed. The Board, under the business of the Public Health Act, have had occasion to have examinations made of above 150 rivers and running streams, and have had analyses made of between 400 and 500 specimens. The average of waters found available for new districts has been about 8 degrees of hardness, while the average of a set of analyses made by Professor Brande of Thames water supplied by the Companies was 16 degrees—that is to say, in the total daily supply, 26 tons of lime are distributed to the inhabitants of London, destroying 25½ oz. of soap in every 100 gallons of water for each grain of lime in a gallon, causing steam boilers to burn out, and inducing increased expenditure in fuel to boil water for any purpose.

But it is a circumstance of important promise for crowded populations in larger town-districts, which we may enunciate as an economical axiom, that the economy and facility of supplying a commodity which furnishes the means of improvement, increase in proportion to the quantity of the commodity consumed. p. 48.

The Report proceeds to cite numerous authorities from Hippocrates and Celsus down to M. Soyer, to show the tendency of hard water to induce diseases, to prevent cleanliness, and cause great waste in cooking operations. Lime in all its forms, it is well known, diminishes the solvent power of water; it is probable therefore that it impedes the process of digestion and assimilation. At Glasgow dyspeptic complaints have diminished in number since soft water was introduced; fever has also diminished, and the cases that occur are more amenable to treatment During the cholera season of 1832 all parts of Glasgow suffered much, but during 1849 the district where soft water has been introduced furnished a comparatively small number of cases, while the epidemic in other parts of Glasgow was very severe. p. 55. At Bolton and Paisley calculous complaints have greatly diminished, and that in the same ratio as the consumption of soft water has increased.

For all purposes of personal cleanliness, soft water is a requisite of primary importance.

The Report contains extensive statistics of the effect of hard and soft water in cooking operations, tea making, and clothes washing. In the latter matter, an "interest" amounting to £5,000,000 annually, it is shown that the waste of "soap" is more than 20 times the first cost of an economic water supply, allowing 7½ per cent. for the use of the capital required.

With respect to the effect of soft water on lead, the Report recommends the use of iron or earthenware piping; though it is believed that the danger is caused by the intermittent system of supplying water into the pipes and making them therefore alternately wet and dry, as in places where a constant supply of soft water has been introduced, there are no complaints of evil arising from the solution of the lead.

The qualities for the water supply of the population appear to arrange themselves in the following order:—

1. Freedom from all animal and vegetable matter, especially matter in a state of decomposition.
2. Pure aëration.
3. Softness.
4. Freedom from earthy, or mineral, or other foreign matters.
5. Coolness in delivery at a medium temperature; neither warm in summer, nor excessively cold in winter.
6. Limpidity or clearness. p. 81.

It is then recommended that the waters of the Thames, the Lea, the New River, the Colne, and the Wandle, as well as that of the other tributaries and sources of the same degrees of hardness, should be as

early as practicable, abandoned. p. 82.

The Report then proceeds to notice the investigations made under the directions of the commissioners with a view to discover the best water within reach of London. Reference is made to the newest water supplies of towns in the North, viz., Glasgow, Paisley, Kilmarnock, Bolton, Bury, Blackburn, Stockport, Manchester, Liverpool, &c., which are derived from elevated gathering grounds, and not from wells or rivers. With reference to the comparative qualities of waters, analyses have been made of 424 different specimens which are classed as follows, viz.:—

	AVERAGE HARDNESS.
1. Wells and springs (264 specimens)	25·86
2. Rivers and brooks (111 specimens)	13·05
3. Land and surface drainage (49 specimens)	4·94

Early in the investigation it was proposed to the Directors of the College of Chemistry, that they should by analyses, determine accurately what matters were taken up by rain water falling on the surface of the soil, and what quantities of such matters were left in the soil or taken out of the water in passing through different sorts of soils, at different depths and arrangements of soils and drains. The College declined. But the examination has recently been made by Professor Way, the chemist of the Royal Agricultural Society, and with the most important results. From his examination it appears that clays and loams have power of chemical action for the removal of organic and inorganic matters from waters to an extent never before suspected, and that it will be practicable to use agricultural drainage arrangements on gathering grounds as a means of filtration and more complete purification of water on a larger scale than is at present accomplished. p. 87.

From these experiments it appeared that an ordinary loam will absorb about $\frac{3}{10}$ per cent. of its weight of ammonia, 1 per cent. of potassa, and $1\frac{1}{2}$ per cent. of carbonate of lime. Part of Richmond Park has been very efficiently drained, and from these works there arises a constant and copious supply of artificial spring water, perfectly clear, soft and well aërated. It comes through a gravelly loam and has about $4\frac{3}{4}$ degrees of hardness, whilst the Thames water immediately adjoining has 13 degrees; Rochdale drainage water has about $4\frac{1}{2}$ degrees, while the surrounding waters have 13 degrees.

The quantity of water lost by evaporation, vegetation, springs, &c., is almost constant, and will range from 15 to 20 inches annual depth. p. 95. This is a most important point in the enquiry.

To be continued.

ON THE LINUM CATHARTICUM.*

BY DR. BUTLER LANE.

THIS well-known indigenous plant has long enjoyed a popular repute as a cathartic and anti-rheumatic, and, from the experience which I have had in its use, I am induced to believe it to be worthy of scientific notice. It belongs to *pentandria pentagynia*, in the Linnæan system, and to the *Linaceæ* of the natural classification, and is, I believe, common throughout England, more especially in limestone and chalk districts, and on hilly ground.

The extractive matter of the linum catharticum appears to be very soluble in water, and but partially so in alcohol. By the action of hot water, the dried plant yields rather more than one-sixth of its entire weight as an extract, leaving merely inert and tasteless vegetable matter. The medicine has usually been administered in the form of an infusion, but its nauseous flavor renders it very objectionable, and as an aqueous extract of proper pilular consistence is readily obtainable, that constitutes the best form for administration. The dose of this is from five to ten grains twice or three times a day: in such quantities, it exerts a mild but efficient cathartic action, generally unattended by griping, and at the same time it sensibly promotes the secretion of the liver. The cathartic action appears to influence both the mucous and muscular structures of the alimentary canal, more especially the upper part of the small intestines. The diuretic action of the linum catharticum will be readily recognised; it obtains to a

* *Medical Times*, July 13, 1850.

considerable extent, and I believe the medicinal virtue to be partly connected therewith. The administration of the linum catharticum produces no specific effect on the nervous system, either depressing or otherwise.

During the last twelve months I have administered the linum catharticum extensively, and can speak highly of its efficacy in various complaints. I have never seen its use attended by any dangerous symptoms, and rarely by any unpleasantness; I, therefore, consider that it may be designated as a very safe medicine. In catarrhal maladies I have found this simple remedy exceedingly effectual, and also in those subacute rheumatic complaints, which are often alike troublesome and intractable. In the cure of affections of the throat and air passages, I consider the counteracting effect to depend on the peculiar stimulation of the mucous and muscular structure of the alimentary canal, and the sympathetic influence extended to the glandular organs connected therewith. Where the morbid action is of rheumatic character, the curative agency is manifested more slowly, and in apparent dependence on the diuretic action; this diuretic action, doubtless, has a modifying power on the constitution of the blood and its relation to the nervous fibre; and thus an alteration is effected in the abnormal dynamic state, on which the rheumatic diathesis depends. In chronic rheumatism, especially when affecting muscular structure, such as lumbago, the use of the linum catharticum is remarkably beneficial, I think more so than that of any other simple medicine. The diuretic power of the linum catharticum is readily manifested when the medicine is administered at short intervals; its action is mild, and unattended with inconvenience. In cases of ascites connected with hepatic disease I have found it very efficient, so much so even, as often to cause patients to request the repetition of the medicine from which they had previously derived so much benefit. The innocence of the medicinal action of the linum catharticum, and the peculiar nature of the complaints in which it is useful, in my opinion, render it admirably calculated for use as a domestic remedy.

Ewell, Surrey.

MEDICO-LEGAL RESEARCHES ON DRIED CEREBRAL SUBSTANCE.*

BY M. ORFILA.

M. ORFILA read an essay before the Academy of Medicine on this subject, with reference to a late assassination. M. Orfila, with M. Jules Barse, had been requested to state whether a certain substance, adhering to the blouse of the accused, consisted of dried cerebral matter. From the smallness of the quantity of this matter (three-tenths of a grain), and the want of recorded investigations on the subject, the inquiry was beset with considerable difficulty. From their experiments M. Orfila submitted the following conclusions on this very important medico-legal investigation:—

1. Among the organs of the human body the brain has a peculiar and specific reaction with sulphuric and hydrochloric acids.

2. The pancreas, digested in concentrated sulphuric acid, imparts in a day or two a violet tint, analogous to that presented by cerebral matter; but this violet tint has been preceded by a yellowish brown and then by a red hue, which do not occur with cerebral substance. Besides this, the pancreas imparts to hydrochloric acid a dull slate grey color, without any violet tint; this also does not occur with cerebral substance.

3. Muscle imparts a violet tinge to sulphuric acid, at the end of a day or two, but this has likewise been preceded by a red tint. With hydrochloric acid the reaction is similar to that of the pancreas.

4. The substances which, adhering to garments or weapons, might be taken for cerebral matter, are, for the most part, white of egg, butter, soft cheese, gelatine, and fat. But these cannot be confounded with cerebral matter if submitted to the action of sulphuric and hydrochloric acids.

5. Albumen imparts a violet color to concentrated sulphuric acid, but with hydrochloric acid a blue color is produced, as deep as that of ammoniaco-sulphate of copper; exposed, however, to heat, a violet color results, which passes into deep (purple) brown. The cerebral matter, on the contrary, does not dissolve in hydrochloric acid, even after twelve days; at the end of several days it presents a slate grey tint, passing faintly into violet, and then to a red, without exhibiting any trace of blue.

Cheese produces a violet color when dissolved in sulphuric acid, but it may be distinguished from cerebral matter by the ready precipitation of the latter on the addition of water. Cheese, also, is precipitated of a black color by chloride of nickel; while cerebral matter is thrown down of a green color, by this reagent, from its solution in sulphuric acid.

Dissolved in hydrochloric acid, cheese

* *Medical Gazette*, July 12, 1850.

which has been dried in the sun presents almost immediately a clear rose, then a violet, and lastly a dull grey, color; whilst brain produces no discoloration for a long time, and then passes to a grey with a very slight violet tint.

6. It was not possible to detect the phosphorus of cerebral matter in so minute a quantity as was presented for examination.

7. Acetic acid was of no use in the experiments.

8. Sulphuric and hydrochloric acids suffice to distinguish cerebral matter from albumen, cheese, &c.

The microscope (of 580 to 600 diameters) detected a very minute quantity of cerebral substance, and confirmed the chemical analysis. The blood-globules may also be distinguished by the microscope if the substance or article to be examined be first treated by a concentrated solution of sulphate of soda.

*** The chemical differences here assigned require further investigation before they can be adopted in practice. This remark especially applies to the action of hydrochloric acid on the cerebral substance. —Ed. Med. Gaz.

PREPARATIONS OF WALNUT LEAVES IN THE TREATMENT OF SCROFULOUS AFFECTIONS.*

Dr. Négrier, a physician at Angers, published a memoir on the efficacy of walnut leaves in scrofula. This first work was followed by a second in 1844. Both contained a very great number of facts in support of this treatment; now new facts have lately been added to those of Dr. Négrier. Thus, M. Nane, professor of clinical medicine at the University of Rome, has published on the same subject a memoir containing 117 observations. Dr. M. Bargiali of Yvres, put forth in 1846, a memoir on the same subject, and Dr. Kreutzwald, has also made known some of his own personal observations. The total number of patients treated by these practitioners, is 127, of whom 47 were radically cured. Among the latter, 19 had other peculiar diseases: eruptions on the head existed in 11; inflammation of the eyes, in 4; inflammation of the ears, in 2, bronchitis, in 1, &c. In several cases, cod liver oil had been employed without success. Dr. Négrier was more fortunate; he says that he cured more than half of his patients. The following are his conclusions:—

I. Scrofulous affections are in general radically cured by the preparations of walnut leaves.

II. The action of this medicine on the system, is so uniform, that we may reckon on the cure of the greater number of subjects treated by this therapeutical agent.

III. The influence of the preparations of walnut leaves is slow, inoffensive, and durable.

IV. The first effects of the treatment are general: its local influence comes afterwards.

V. Scrofulous affections of the skin, of the mucous membrances of the vascular system and of the lymphatic ganglia, are cured as easily, as promptly, and more surely by the preparations of walnut leaves, than by any other method at present known.

VI. Affections of the osseous, cartilaginous and ligamentous systems, of a scrofulous nature, are sometimes cured radically by the preparations of walnut leaves alone. Lymphatic subjects always derive benefit from them: the considerable modification which they experience often includes cure of caries of the bones and their appendages. These same osseous affections, in dry and nervous subjects, are not perceptibly modified by the treatment. Cod-liver oil is then preferable, associated with infusions of the leaves or green shell of the nut.

VII. Scrofulous ophthalmia is surely and promptly cured by treatment based on the preparations of walnut leaves.

Dr. Négrier, gives the dried leaves in infusion in the proportion of 5 grammes of leaves to 500 grammes of water. It is sweetened with honey or walnut syrup, which is thus prepared. Extract of walnut leaves, 4 grammes; dissolve in a very small quantity of water, and add to 300 grammes of boiling syrup; it is prescribed in the dose of 30 grammes. The pommades, which are employed in friction for a quarter of an hour, twice a day, are composed of:—

Extract of walnut leaves	30 grammes.
Lard	40 grammes.
Essence of bergamotte	15 centigr.

The collyrium to which the author gives the preference in scrofulous ophthalmia, is the following:—

Decoction of walnut leaves	200 grammes.
Extract of belladonna	1 "
Thridace	1 "

Then he prescribes, morning and evening, after the meal, a tea-spoonful of walnut wine prepared with from 50 to 60 grammes of fresh leaves, or 10 or 12 nuts covered with their green shell, cut in pieces and macerated in a quart of Malaga or Lunel; in winter, this wine is prepared with from 15 to 20 grammes of extract to the quart.

Although we do not participate to the

* *Archives Générales de Médecine.*

same degree as Dr. Négrier in his confidence in the preparation of walnut leaves, it must still be admitted, from the observations published by him and others, that this medicine may render considerable services in scrofulous affections, and that it may be regarded as an excellent substitute for skate or cod-liver oil, and that in many cases, it should be employed in preference, on account of its moderate price and the facility with which it may be obtained throughout France.

ANÆSTHETIC ACTION OF PROTO-CHLORIDE OF CARBON AND DUTCH LIQUOR.

BY SENOR ALVARO REYNOSO.

I HAVE been led to investigate the action of these bodies on the animal economy, by certain analogies, in their chemical properties, with chloroform.

Having experimented on animals and on myself, I have concluded:—

That these bodies, like chloroform, possess the anæsthetic property.

That animals submitted to their action may safely inhale a much larger quantity of these liquids than of chloroform.

That the state of insensibility lasts much longer than with chloroform or ether.

The high price and bad odor of proto-chloride of carbon will always be opposed to its employment in surgery; but Dutch liquor, from its agreeable odor, is, I think, deserving of a trial in surgical operations.

ON THE ROOTS OF THE POMEGRANATE.*

BY M. F. CADET GASSICOURT.

HAVING received some roots of an old wild pomegranate recently pulled up near Algiers, I was desirous of verifying on this product of certain origin, the characteristic properties of this medical substance, which are often obscure in the old and dry bark of commerce.

Although I recommended that only the bark should be sent to me, I have received the whole of the roots. The reason was very soon explained by the difficulty I experienced in detaching the cortical portion from the ligneous portion. They are united to each other, in the old and strong branches, with so much force, that I was able to divide them only by means of blows with a heavy hammer.

The wood denuded of its bark is dense, even, and of a fine yellow color, particularly when the root is alive and healthy. This ligneous matter, put in contact with sulphate of iron in solution, immediately turns black.

The bark of the younger branches is detached with less difficulty; this appears to be the origin of the bark of commerce, only it is more curled up and very dry.

The bark of the root of the African pomegranate, while fresh, is extremely grey and wrinkled; its internal surface is yellow; its taste, generally very astringent with a sweet aftertaste, differs according to the size of the roots from which it is obtained. If we may often judge of the medical action of a vegetable substance by the intensity of its physical properties, the bark of the pomegranate root of medium size, is, in this case, possessed of the greatest efficacy.

Water instantly removes from the internal surface of the bark its coloring principle. Writers on materia medica correctly state that this surface, steeped in water, and then rubbed on white paper, leaves on it a yellow mark, which, put in contact with sulphate of iron, turns blue. But when these authors add, that the yellow mark left on the paper produces, by contact with an acid, a light rose tint which vanishes immediately, they go too far, for it is necessary to specify the nature of the acid. Thus, nitric acid produces this reaction, whilst hydrochloric and acetic acids do not produce any apparent action; sulphuric acid, on the contrary, causes a very powerful color of wine lees or lilac, which remains for a much longer time than the rose tint obtained with nitric acid.

* *Journal de Pharmacie*, June, 1850.

CASE OF FATAL POISONING BY SIR WILLIAM BURNETT'S FLUID.*

BY H. LETHEBY, M.B., LECTURER ON CHEMISTRY IN THE MEDICAL SCHOOL OF THE LONDON HOSPITAL.

THE author commenced by expressing his belief that no fatal case of poisoning by chloride of zinc is on record—a remarkable fact, as the very commonly employed deodorising fluid referred to is a very strong solution of this poisonous salt. It will be found that the writings of the leading toxicologists, English and French, contain no mention of this salt as a possible source of danger to the community.

The case related is that of a little girl, aged fifteen months, at Reddingfield, in Suffolk. Mr. Miller of Eye, in the same

* Read before the Royal Medical and Chirurgical Society.

* *The Lancet*, July 6, 1850.

county, was called to her on the 16th of August, 1849.

She was in a semi-comatose state, the vital powers being much prostrated, the countenance pale and anxious, the breathing thoracic and rapid, the pulse quick and fluttering, and the general surface of the body cold, and bedewed with perspiration. The swelling of the lips, and the thick transparent mucus adhering to them, led to further examination, and the lining membrane of the mouth was found to have the appearance of having undergone the action of a corrosive substance.

The child had been well in the morning, and only an hour and a half before Mr. Miller saw her had been seized with most violent sickness. A bottle of Sir William Burnett's fluid had been supplied to the mother some days previously, in consequence of some cases of fever in the house she inhabited.

On rousing the child, it craved for cold water, which evidently refreshed its mouth; but little, if any, could be swallowed, and it was partly returned by the nostrils. The throat was evidently swollen and painful. No relief could be given; vomiting of a frothy liquid took place at intervals, but the coma became deeper, the respiration slower, the pulse more feeble, and ten hours after the symptoms had commenced, the child died.

The body was examined twenty-two hours after death. Marks of the corrosive poison were found on the lips, lining membrane of the mouth, fauces, and œsophagus, which were white and opaque. The outer surface of the stomach had a mottled appearance, from ramifications of dark purple vessels; the intestines looked paler than natural. The stomach felt hard and leathery, and contained an ounce and a half of a fluid resembling curds and whey. Its inner surface was corrugated, opaque, and tinged of a dark leaden hue; this appearance ceased abruptly at the pylorus. The lungs were slightly congested; the auricles of the heart full of dark, semi-fluid coagula; the ventricles empty. The kidneys were much congested. The interior of the stomach was slightly acid to litmus paper, and on digesting the organ in an ounce of distilled water, the liquid obtained gave white precipitates with prussiate of potassa, carbonate of soda, sulphuretted hydrogen, and acid nitrate of silver, no precipitate being obtained on the addition of a soluble salt of baryta. The presence of chloride of zinc was thus demonstrated. The fluid matter taken from the stomach, and that ejected by vomiting, on being filtered and tested, gave the same reaction. The tissue of the stomach was then broken up with nitro-muriatic acid, the solution evaporated to dryness, re-dissolved in distilled water, filtered and precipitated with sulphuretted hydrogen, by which means 3·8 grains of sulphuret of zinc were obtained, a quantity equal to 3·2 grains of the oxide, 5·4 of the chloride of the metal.

The fluid in the possession of the mother had a density of 1·600, was slightly acid, and contained 52 per cent. of the solid chloride. Experiments made with this liquid, in order to determine its leading chemical and physiological characters, showed:—

1st. That the chloride of zinc is distinguished from the other salts of the metal by its quick and firm coagulating action on liquid albumen and on the delicate tissues of the body.

2nd. That a solution of chloride of zinc exerts a twofold action on the living animal economy.

Its first effect is that of an irritant and caustic; the liquid coagulates the tissues, and gives pain in the part to which it is applied, and almost instantaneous vomiting. It appears, moreover, from the investigations of Orfila, that the salts of zinc act upon the stomach, not only when they are introduced into this organ, but also when they are injected into the blood-vessels of the body, or applied to a wounded surface.

The second effects are of a constitutional nature, and it would appear that the poison exerts a distinct and specific action on the motor and organic systems of nerves, for soon after the poison gains access to the circulation, the breathing and pulse become accelerated, paralysis of the voluntary muscles commences, the surface of the body grows cold, the pupil is dilated; the circulation and respiration become more and more affected, and lastly the brain suffers, coma supervenes, and death takes place without a struggle.

The author stated, moreover, that his experiments prove the poison to be absorbed from the alimentary canal, and carried into the general circulation; he has detected the metal in the blood removed from the heart, in the tissues of the body, and in the urine excreted during life. The appearances presented by the blood indicate that the poison exerts some particular action on this fluid, which is found black and uncoagulated, and the cavities of the heart are distended as if the organ had lost the power of contracting on its contents.

Mr. URE said that chloride of zinc had been found of much service in surgery. He had used it pretty extensively, and some years since had pointed out its remarkable

affinity for albumen. In his practice, no symptoms of its absorption into the system had been manifested. He agreed with the author of the paper respecting the action of sulphate of zinc on the economy.

Dr. LETHEBY remarked, that his experiments went to confirm the observations made by Mr. Ure, as to the great insolubility of the coagulum formed by albumen and the chloride of zinc. He had observed, for instance, that when an albuminous tissue, as the stomach of an animal, had been acted on by this agent, and was afterwards steeped in water for a length of time, it would neither dissolve nor decompose, nor even yield up the bulk of the salt with which it was in combination. This was evidence of the great affinity of this compound for albumen. He considered that the chloride of zinc might generally be used as a caustic, with little fear of its entering the circulation, or of producing effects on the general system. His investigations, however, had shown, that when given internally, the poison always found its way into the circulation. In the cases before the Society, he had been able to detect the metal, not only in the animal tissues, and in blood taken from the heart, but also in the urine voided by the animal during its lifetime.

IV. REVIEWS, NOTICES OF BOOKS, &c.

ELEMENTS OF URINARY ANALYSIS AND DIAGNOSIS, CHEMICAL AND MICROSCOPICAL: being concise directions for a Chemico-Pathological Examination of the Urine and Urinary Concretions, &c., with a view to determine the nature of some obscure forms of disease, and their effects upon the economy in general, from the morbid condition of the Urine. By ROBERT VENABLES, A.M., M.B., Physician to the Diabetic Dispensary, &c. &c. Second Edition. London: George Knight & Sons. Pp. 66.

THIS is one of the very useful series of Manuals published by Messrs. Knight, the well known manufacturers of chemical and philosophical instruments, and is intended as a guide to the use of a very complete set of apparatus and reagents called "The Urino-Chemical Chest," in which our medical readers will find everything requisite for the examination of urine and urinary concretions. With the Manual and the Chest, any medical man may soon make himself practically acquainted with the modes of examining the urine and its pathological formations.

It is well known that these examinations are so indispensably necessary in many diseases, that those who are unable to make them are very ill-caculated to treat those diseases. No medical man ought to be without such means as the Messrs. Knight have placed at his disposal.

In the present edition, the most important addition is the chapter on "Microscopical Analysis," in which the directions are exceeding simple and easy to follow.

BOOK RECEIVED.

Electric Telegraph Manipulation. By CHARLES V. WALKER, Esq., Superintendent of Electric Telegraphs to the South-Eastern Railway Company. G. Knight and Sons.

TO CORRESPONDENTS.

"BETA, CHEMICUS."—If you will forward your address, we will write to you.

"W. S." will receive a private letter.

SUMBUL.—The numerous correspondents who have written to us enquiring where the Preparations of Sumbul can be obtained, are informed that, conceiving Messrs. Savory and Moore were at present the only importers of that article, we wrote to those gentlemen, and received in reply a note stating that they have prepared the Proof Spirit Tincture, Alcoholic Tincture, Etherial Tincture and Extract.

"J. P."—We will prepare the abstract you wish for, and send it by post in a few days. Your letter was delayed a month before it reached us, which will account for apparent want of courtesy.

Communications have been received from "E. M. L.;" "H. (Pharm. Soc.);" "ENQUIRER;" "A PHARMACEUTIST;" "M. P.S.G.B." (several with this signature); "JUSTITIA;" "A SUFFERER;" "A. B.;" "X.;" "A.P.S.;" "CHEMICUS;" "OMEGA," on subjects connected with the Pharmaceutical Society. We have not room for a tithe of the communications which reach us on the subject which is now being worked at; but we are obliged to the writers.

NOTICE.—*All Communications, Books for Review and Substances for Notice must be addressed* "To the Editors of THE CHEMIST, care of Messrs. W. & T. Piper, Paternoster Row, London." *Communications for insertion must be prepaid, and sent before the 15th of each month. Letters requiring a reply in the following No. will in future be received as late as the 24th.*

THE CHEMIST.

[NEW SERIES.]

I. CHEMISTRY.

CHEMICAL INVESTIGATIONS ON THE EGGS OF THE CARP.

BY M. GOBLEY.

(Concluded from page 486.)

LECITHINE AND CEREBRINE.

We have just stated that when the yolk of the fowls' egg is treated by alcohol or by ether, we obtain by the evaporation of the liquid:—1, a fixed oil which has long been known under the name of oil of the egg; 2, a soft substance of viscid consistence. I have also said that the eggs of the carp, treated in the same way, did not furnish any perceptible quantity of fixed oil; almost the whole of the fatty matter is, indeed, formed of a viscid matter which presents the greatest analogy with that of the yolk of egg and which possesses its properties. The eggs of the carp contain, however, a certain quantity of fixed oil, but the proportion is very small.

In order to obtain the fatty matter of the eggs of the carp, we commence by depriving them of a portion of the water they contain; they are afterwards treated with ether or boiling alcohol; there remains a considerable residue formed of albuminous matter, of the envelopes of the eggs, and of the membranes which hold them together. The liquid filtered and evaporated gives the fatty matter: 100 parts of carps' eggs furnish on the average 6·200 of this substance.

When the fatty matter of the eggs of the carp is treated by boiling alcohol, almost the whole of the substance is dissolved, and only a small quantity of fixed oil is left; the liquid, by cooling, furnishes a soft substance which I will designate most frequently under the name of viscid matter.

This substance is of a complex nature, like that of yolk of egg, of which it possesses all the properties; the acids and alkalis, diluted, exert on it the same remarkable action, only in the numerous experiments which I have made, I have observed that it offered rather more resistance than yolk of egg to their action; but, moreover, as I have just said, the reactions are always the same.

Thus, by acting on the fatty matters of the eggs of the carp, with water containing either a mineral acid, or potassa or caustic soda, we obtain, as with the viscid matter of fowls' eggs: 1, oleic acid; 2, margaric acid; 3, phosphoglyceric acid; 4, a grey or white nitrogenous substanee, and, besides, a certain quantity of fixed oil.

Alcohol greatly facilitates the decomposition of the viscid matter of the eggs of carp by the acids and by the alkalis, as in the case of that of fowls' eggs.

The vegetable acids act with the fatty matter of the eggs of carp as with that of fowls' eggs; they decompose it with extreme difficulty.

I have remarked that the carbonates of potassa and soda act as caustic alkalis, although with much less energy, on the viscid matter of fowls' and carps' eggs. When we agitate in a flask 10 parts of one of these substances, 10 parts of carbonate, and 60 parts of distilled water, after several days' contact, they have experienced no perceptible modification; by raising the temperature to boiling, there is no decomposition; but if the mixture be boiled for a very long time, we obtain, after the cooling of the liquid, a bulky gelatiniform mass, which, decomposed with heat, by acetic acid, furnishes oleïc and margaric acids.

A very small quantity of mineral acid, potassa or soda is sufficient for determining the formation of oleïc, margaric and phosphoglyceric acids. In my previous memoirs, I stated that it was the same with the viscid matter of the yolk of the fowls' egg.

The air, or the oxygen of the air, appears to have no perceptible action on the fatty matter of fishes' eggs. To prove this, I repeated all the experiments which I had made on fowls' eggs, and I ascertained that these gases had no influence on the reaction which I had pointed out, that the fatty matter of the eggs of fish contains the elements of oleïc, margaric and phosphoglyceric acids, and that it furnishes them without the intervention of the oxygen of the air.

The general properties of the fatty matter of the eggs of the carp having thus been studied, it remains for me to make known its nature.

It will be recollected that, in a former memoir, I have stated that, after having thought that the viscid matter of the yolk of the fowls' egg consisted of a mixture of oleïc, margaric and phosphoglyceric acids, combined with ammonia, I was led, by further experiments to form a different opinion.

It will also be remembered that, in consequence of researches on the fatty matter of the brain, I was led to believe that the phosphuretted substance of that organ presented so great an analogy of composition to that of yolk of egg, that there could be no doubt of its being the same substance, or derived from it; finally, I have stated by what means I discovered the substance which presented the greatest analogy to that which Vauquelin, M. Couerbe and M. Fremy found in the brain, and which they respectively designated under the names of white fatty matter of the brain, cerebrote, and cerebric acid.

All the experiments which I had made on the viscid substance of the yolk of egg were repeated on the eggs of the carp, and led to the same results.

I therefore found in the eggs of the carp, as in those of the fowl, two of the fatty matters which exist in the brain. These two substances which I shall examine successively, are intimately connected with each other, and I have not been able to separate them without decomposing one of them; they are always accompanied by a certain quantity of fixed oil and cholesterine, from which I found it impossible to completely free them, all these bodies mixing and dissolving in each other with the greatest facility.

These two substances very evidently constitute neutral bodies, for the yolk of the fowls' egg and the eggs of the carp, freed from soluble salts by treating several times in boiling water, furnish a viscid matter which exerts no action on the vegetable colors, which contains neither potassa, soda, nor ammonia. They are united, it is true, with a certain quantity of phosphates of lime and magnesia, which cannot be separated by means of alcohol and ether, but these salts do not constitute bases, and we know, besides, with what facility they unite with most organic matters. One of these bodies contains a large proportion of phosphorus, the other contains nitrogen. I propose to give to the first the name of *lecithine*, because it is found in large quantity in yolk of egg; and, to the second, that of *cerebrine*, to call to mind its analogy to the cerebrote of M. Couerbe and the cerebric acid of M. Fremy.

LECITHINE.

I have not been able to obtain this substance in a state of purity: it forms the greater part of the viscid matter of the yolk of fowls' eggs and of the fatty substance of the eggs of fish. It is a soft, viscid body; it is miscible with water, with which it forms an emulsion; it is sparingly soluble in cold water, and dissolves in boiling water, from which it separates in great part by cooling; it is entirely soluble in ether, and undergoes no alteration in the air. Exposed to the action of heat, it does not fuse, but swells up, turns black, and leaves an acid charcoal which owes its acidity to phosphoric acid. Under the influence of the acids and alkalis, it always yielded with the greatest facility, oleïc, margaric and phosphoglyceric acids. The facility with which lecithine furnishes these three acids, renders it one of the most curious principles of the animal organisation. The products which it gives in decomposing in vacuo, induce us to regard it as formed of phosphoric acid, oleïne and margarine, but does it result from the combination of the former of these bodies with the other two, or does it constitute a peculiar body?

M. Fremy thinks that it forms a compound analogous to sulpholeïc acid, which he obtained by acting with sulphuric acid on olive oil.

I regret that I do not agree with this distinguished chemist.

The matter which I found in the yolk of the egg and in the eggs of fish does not possess, as I have already said, acid properties, since it exerts no action on litmus and is combined with no base.

When we agitate, according to M. Fremy, two parts of olive oil with one part of sulphuric acid, we obtain a viscid compound

which, after 24 hours, may be regarded as a mixture of sulpholeïc, sulphomargaric and sulphoglyceric acids.

Sulphuric acid determines, in this case, as MM. Caventou, Chevreul and Bracounot long since demonstrated, the conversion of oleïne and margarine into fatty acids and glycerine, but I have not found that by acting with sulphuric acid on olive oil a body is obtained which behaves like the phosphuretted substance of fowls' and fishes' eggs.

The viscid compound of M. Fremy, put in contact with water, is decomposed at the ordinary temperature, and gives rise to products which are modified under the influence of this solvent. The phosphuretted matter of the yolk of egg and of the eggs of fish, not only does not decompose at the ordinary temperature when it is put in contact with water, but, moreover, it undergoes no sensible alteration by this reagent, even after prolonged boiling. It gives rise to perfectly clear and definite products, namely: oleïc, margaric and phosphoglyceric acids.

The phosphuretted substance exerts no action on litmus, whilst M. Fremy's compound possesses a very acid reaction. It might, perhaps, be supposed that this acidity is due to the employment of a great excess of sulphuric acid: but experience has proved to me that a very acid compound is always obtained by acting with sulphuric acid on olive oil, even when the acid is in very small quantity.

These distinctive properties appear to me to establish a line of demarcation between the phosphuretted substance and the product of the action of sulphuric acid on olive oil.

I may add that all my endeavors to combine phosphoric acid with oleïne and margarine have been attended with no result.

I have said that I always extracted from the phosphuretted matter of the yolk of egg, of the eggs of the carp, and of the cerebral fat, oleïc, margaric and phosphoglyceric acids, and that these substances never yielded me phosphoric acid or neutral fatty bodies.

M. Fremy, in his memoir on the brain, says that oleophosphoric acid always gave him oleine and phosphoric acid. With this substance I never obtained these two bodies, although operating according to the directions given by that chemist. It is very easy to be led into error by the phenomena which accompany the reactions. Thus, as I demonstrated in my former memoir, when, instead of using, for decomposing the viscid matter, water acidulated with the mineral acids, acidulated alcohol is employed, an aqueous liquid is obtained, which contains, not phosphoric acid, but phosphoglyceric acid and an oily liquid which, besides oleïne and margarine, contains a large quantity of oleïc and margaric acids.

The body which results from the decomposition of the viscid matter by acidulated alcohol is, therefore, formed of fixed oil and fatty acids; but the neutral fatty body is not the essential product of the reactions; it is the acid fatty body, and this is proved beyond dispute by the existence in the aqueous liquor of phosphoglyceric acid, and not of phosphoric acid.

As to the fixed oil it is nothing but that which accompanies the viscid matter.

Thus, under the influence of acidulated alcohol, as under that of acidulated water, the viscid matter of the fowls' egg, of the eggs of fish, and of the cerebral matter, gives the same products; only, the margaric acid crystallises in the presence of an aqueous liquid, which does not take place in alcohol.

When the oily liquid which results from the action of acidulated alcohol on the viscid matter is left to itself as soon as it is obtained, it at first deposits a soft, white substance, which is *cerebrine;* if the temperature be gradually lowered to the degree at which ice melts, besides cerebrine, a large quantity of cholesterine is separated.

The filtered liquid presents a reddish yellow tint and an oily consistence; it powerfully reddens litmus. Water has no action on it; however, by prolonged contact of the two liquids in a flask, part of the margaric acid crystallises. When the oily liquid is boiled in water, it does not undergo any alteration. Ether completely dissolves it; alcohol at the ordinary temperature dissolves only a small quantity of it; by spontaneous evaporation, oleïc acid and a small quantity of crystallised margaric acid are obtained. Boiling alcohol dissolves a considerable proportion of it; the portion dissolved separates by cooling under the form of an oily liquid, which contains oleïc and margaric acids; the undissolved portion consists of oleïne and margarine.

When the oily liquid is boiled in water acidulated by sulphuric acid it does not undergo any perceptible modification. By substituting a solution of potassa for the acidulated water, an emulsion is immediately formed, which, decomposed at the boiling temperature by an excess of acetic acid, furnishes crystallised margaric acid, oleïc acid and fixed oil. When the oily liquid is agitated in a tube with alcohol and potassa, two layers are formed by repose: the upper one, which is oily, is formed of oleïne and margarine; the lower one, which is aqueous, contains the fatty acids combined with the potassa; if the alcoholic solution

of potassa is concentrated, and if the oily liquid is in excess, the aqueous liquor forms a transparent jelly on which the fixed oil floats; by this means, the fixed oil of the fatty acids may be completely separated. Moreover, by decomposing at the boiling temperature, by acetic acid, the aqueous or gelatinous liquid, the oleïc and margaric acids are obtained.

Lime water, put in contact, with the oily liquid, gives rise to a lime soap which is mixed with fixed oil, cholesterine and cerebric matter.

The neutral acetate of lead is precipitated by the oily liquid; in this case, a lead soap is formed. Oxide of lead readily unites with the oily liquid; if either precipitate be treated with ether, margarate of lead is obtained as a residue.

Thus, oleïc and margaric acids really exist in the oily liquid, only their properties are disguised by the different principles which accompany them. I have stated that oleïne and phosphoric acids had been regarded as the only bodies which result from the decomposition of the phosphuretted substance. M. Fremy did not notice margarine among his products; I have never obtained oleïc acid without at the same time finding margaric acid. In accepting the ideas of M. Fremy, it must be considered that the phosphuretted matter is a mixture of oleophosphoric acid and margarophosphoric acid. Oleïne, moreover, has never been found separately in the animal economy, whilst by the reaction which I have discovered, the presence of oleïc and margaric acids in the brain, blood, &c., &c., is easily explained, for these bodies are, without doubt, products of the decomposition of lecithine.

We shall now enter upon the study of the fatty acids and of the phosphuretted body, and show that they present the same properties and composition as those extracted from the fowl's egg.

OLEÏC AND MARGARIC ACIDS.

These acids do not pre-exist in the eggs of the carp; they are, as I have said, the result of the decomposition of lecithine. To obtain them, I followed the process which I pointed out in my first memoir, and they presented the same properties and composition as furnished by the yolk of the fowls' egg.

By analysis, 0·310 gramme of margaric acid of the eggs of the carp furnished 0·855 of carbonic acid and 0·350 gramme of water, which gives in hundredths:—

Carbon	75·337
Hydrogen	12·483
Oxygen	12·180
	100·000

The oleïc acid gave me, for 0·421 of substance, 0·438 gramme of water and 1·194 gramme of carbonic acid, which gives in hundredths:—

Carbon	77·348
Hydrogen	11·350
Oxygen	11·293
	100·000

Thus, the fatty acids which are extracted from the phosphuretted matter of the eggs of the carp are identical in properties and composition with those furnished by the yolk of the fowls' egg.

PHOSPHOGLYCERIC ACID.

To obtain this acid, I also followed the process which I pointed out in my first memoir. After having decomposed the viscid matter by potassa and acetic acid, the liquor may be saturated with lime, and the phosphoglycerate which is formed may be precipitated by alcohol. This salt is redissolved, after being received on a filter, in distilled water; the liquor is again filtered and decomposed by a slight excess of acetate of lead. The phosphoglycerate of lead thus obtained is treated, for the rest, as we have stated. This process succeeded better than the preceding for obtaining the phosphoglyceric acid from fishes' eggs.

The phosphoglyceric acid of the phosphuretted substance of the eggs of the carp is identical with that furnished by yolk of egg. Like it, it combines with lime and forms a salt which possesses the properties and composition of phosphoglycerate of lime.

The following are the results obtained by analysing this salt:—

0·341 gramme of lime salt, dried at 248° F., left, by decomposition with nitric acid and heat, 0·205 gramme of ash composed of phosphate of lime, or 60·11 per cent.

Combustion by means of chromate of lead gave:—

0·810 gramme of lime salt, dried at 248° F., furnished 0·260 gr. of water and 0·506 gr. of carbonic acid.

This leads to the composition in hundredths (C=75; H=12·50; O=100; Ca=350; Ph=400):—

Phosphate of lime	60·11
Carbon	17·03
Hydrogen	3·56
Oxygen	19·30
	100·00

I obtained for the phosphoglyceric acid of the yolk of the fowls' egg:—

Phosphate of lime.....	60·27
Carbon.....	17·07
Hydrogen.....	3·51
Oxygen.....	19·15
	100·00

The phosphuretted acid which is extracted from the eggs of the carp is, therefore, like that furnished by the yolk of the fowls' egg, phosphoglyceric acid.

[Much as we dislike the practice of continuing articles from one volume to another, we are unable, in this case, to avoid doing so, as the completion of M. Gobley's paper is not yet given in the *Journal de Pharmacie*.—EDITORS.]

ON THE COMPOSITION OF CORN.*

BY M. PELIGOT.

(Concluded from page 483.)

CELLULOSE.

THE determination of the cellulose contained in corn occupied me a long time, for no chemist has hitherto made known a process for arriving at it. M. Millon, who was engaged at the same time as myself in the estimation of this substance, and who recently communicated to the Academy the results at which he arrived, does not point out, in the abstract of his memoir published in the *Comptes Rendus de l'Académie des Sciences*, the method he employed for demonstrating that the proportion of cellulose attributed to bran and farina is greatly exaggerated. Although I entirely coincide with M. Millon as to the tendency of the results of his work, I have arrived at other numerical results, probably owing to my having employed another process. When his process is published, it can be compared with mine, and this comparison will not be without interest; for the accurate determination of the cellulose will certainly have much influence on the composition at present attributed to the greater number of useful vegetables.

It was by studying the action which sulphuric acid, of various degrees of concentration, exerts on each of the matters contained in wheat, that I was led to employ the process which I am about to describe. I have proved that by putting starch, and dry or even humid gluten, in contact with sulphuric acid containing 6 equivalents of water, prepared, consequently, by adding to 100 parts of ordinary sulphuric acid 91·8 parts of water by weight, these bodies dissolve, especially if the mixture be kept for some time at from 158° to 176° F. The starch is converted into glucose, and the insoluble nitrogenous matters of which gluten is constituted are transformed at first into products soluble in the sulphuric acid employed, which separate from it under the form of flocks when water is added to the acid liquor, but which remain dissolved in it when a certain quantity of acetic acid is added to it. Moreover, these matters become entirely soluble in water, when the acid mixture has been kept for a rather longer time at a temperature near the boiling point of water. This liquor is tested from time to time, and the heating is stopped when it is no longer rendered turbid by the addition of water.

On putting ground corn in contact, for twenty-four hours, with sulphuric acid containing 6 equivalents of water at the ordinary temperature, the paste which is at first produced finally becomes liquid; it becomes translucid. It presents a violet color which arises, I think, from the alteration which the fatty matter undergoes from the action of sulphuric acid: by heating the liquid for some time, it becomes blackish, this alteration becoming more profound. This color, like the preceding, disappears on the addition of water; the liquid contains in suspension the cellulose, which arises as much from the external envelope of the grain as from its interior cellules. This cellulose, which is pulpy, is washed first with warm water, and afterwards with a solution of caustic potassa, which removes from it a portion of the fatty matter and a brown matter which is found in abundance in this residue: after another washing in warm water, in weak acetic acid, then in water, and, finally, with alcohol and ether, the filter is dried at 230° F., and tared with a filter of the same paper, which was made to undergo the same washings by pouring on it the liquids arising from the various operations which I have just described. The augmentation of weight which it presents indicates the quantity of cellulose furnished by the matter analysed.

On examining the cellulose obtained by this process with the microscope, I found it impossible to detect in it anything but this matter itself, which occurs under the form of very fine elongated cellules, but in no way altered. The tissue found in the interior of the grain is distinguished from the internal cellular tissue, inasmuch as the latter is entirely colorless, whilst the other presents a slight brown coloration, especially when it results from red or very hard corn. The cellulose of the cortical envelope likewise appears thicker.

The process which I have just described for determining cellulose appears to me

* *Annales de Chimie et de Physique.*

applicable to the estimation of this substance in most vegetables. It might be possible, nevertheless, that the less aggregated cellulose which certain plants contain might be dissolved, at least partially, by sulphuric acid with 6 equivalents of water, which, moreover, does not injure the filtering paper, for it filters through it without perforating it. In this case, rather weaker sulphuric acid might be employed, which, very probably would still dissolve with, and even without heat, all the vegetable substances which accompany cellulose.

Ground corn, treated by this process, left much smaller proportions of cellulose than are generally supposed to exist in it. I will here give some of the numbers which I obtained.

21·5 gr. of Flemish white wheat yielded 0·400 of cellulose, or 1·8 per cent.

15 gr. of pollard wheat (average year) left 0·225 of cellulose, or 1·5 per cent. Another analysis gave 1·9 for the same wheat.

15 gr. of hardy white wheat left 0·235 of cellulose, or 1·5 per cent.

15 gr. of *mitadin* of the South left 0·220 of cellulose, or 1·4 per cent.

42·50 gr. of Tangarock wheat left 1·004 of cellulose, or 2·3 per cent.

300 grammes of wheat, already disaggregated by sulphuric acid and steam, arising from four different sorts of wheat, left 4·500 of cellulose, or 1·5 per cent.

These analyses show that the quantity of cellulose contained in wheat is much less than is generally supposed. I think that they have still furnished too large a quantity; for I found it impossible to obtain this product perfectly colorless, notwithstanding the repeated employment of the solvents. This cellulose represents moreover, evidently, not only the cortical envelope of the grain—nearly the whole of which envelope is contained in the bran left by bolting—but also the interior cellulose of the grains of wheat. This latter should pass into the farina, but it is found in it in such small quantity, that its accurate determination appeared to me impossible. The small proportion of cellulose which I found in wheat led me to determine that which is found, so to speak, concentrated in bran. I treated by sulphuric acid, containing 6 equivalents of water, four samples of bran obtained in commerce, then I washed the residues which they left with acetic acid, ammonia, potassa, water, alcohol, and, finally ether. They furnished per cent.:—

Cellulose 7·0, 7·8, 9·3, 8·0. Mean 8·0.

Comparing the mean of these numbers with [illegible]ich represents the cellulose contained in corn, and supposing that all the cellulose passes into the bran (which is not quite correct, as I have said above), it is evident that the bran, containing 8·0 per cent. of cellulose, resulted from a sample of corn which would have furnished one-fifth of its weight of bran—a result which is often obtained in practice by the ordinary processes of grinding.

The results which I have just mentioned agree with those obtained by M. Millon, since that chemist found, in brans of various nature, from 8 to 10 per cent. of ligneous matter. As to the conclusion which he draws from the analysis of bran which he has published—*that bran is an essentially alimentary matter*—without disputing anything but its novelty, for I think that it is very generally admitted, I may remark that the difficulty which the preservation of bran in flour intended for the preparation of bread presents appears to me to result not only from the presence of cellulose, but also from the excess of fatty matter which the bolting separates from ground corn not less usefully than cellulose itself. Like M. Millon, I found that bran contains 3 to 3·5 per cent. of fatty matter. MM. Dumas, Boussingault and Payen had previously arrived at the same result; M. Boussingault, indeed, gives the analysis of a bran, which, dried at 212° F., contained 5·5 per cent. of fatty matters. Indeed, 100 parts of corn had furnished only 13·7 of bran. I examined comparatively many samples of brans and farinas from the same corn, and I ascertained that the quantity of fatty matters retained by the brans was ordinarily at least triple that remaining in the farina. This fact is explicable if we consider that the germ of corn, which is so rich in fatty matters, must be principally retained by the cortical envelope to which it adheres, and which constitutes the bran. Thus the fatty matter of farinas of good quality never represents more than 1 per cent. of their weight. This proportion I consider necessary for the preparation of bread; but I also think it cannot with impunity be exceeded when it is required to make, not only nutritive bread, but, which is an essential point with respect to food, bread of agreeable taste and appearance. That which gives, indeed, to brown bread its greyish cavities, that kind of translucency, and the property of retaining more water than white bread of the best quality, is less the cellulose that it contains than the fatty matter which is found in greater proportion than in white bread. This appeared to me especially evident in bread made of rye, whose farina contains, according to M. Boussingault, 3·5 per cent. of

fatty matters. If this bread is more hygrometrical than that of wheat, and more difficult to make, although it contains nearly the same proportion of nitrogenous principles, it is to this proportion of fatty matters, which is relatively high, that these differences must be attributed. These observations are not intended to throw any doubt on the improvements which M. Millon proposes to introduce into the manufacture of ammunition bread, but to show that the difference which exists between this bread and white bread resides not only in a few hundredths of ligneous matter more or less, but especially, in my opinion, in an excess of fatty matter, which is opposed to such good panification as is obtained with farinas of the best quality. I intend, however, to return to this important subject, by studying the panification of the different cereals.

ANALYSIS OF FOURTEEN SAMPLES OF CORN.

No. 1. White Flemish corn, said to be damaged, gathered at Vienne in Dauphiné, in 1841. From the collection of M. O. Leclerc Thouin.

No. 2. Corn of Scottish origin: very white; cultivated by M. Vilmorin at Verrières, since 1839. This corn was gathered in 1843.

No. 3. Very tender corn; very white; gathered in 1842.

No. 4. Mixed corn from Russian Poland; given to me by M. P. D'Arblay.

No. 5. Tender corn, sown in March, 1842.

No. 6, Half-glazed corn, gathered in 1840, in the department of the lower Loire.

No. 7. Half-glazed corn, gathered at Verrières, in 1844, by M. L. Vilmorin.

No. 8. The same, crop of 1846.

No. 9. Half-glazed corn, grown in the neighborhood of Avignon.

No. 10. Very hard corn, in very long grains. Origin, North of Africa. Cultivated by M. L. Vilmorin, at Verrières. Gathered in 1844.

No. 11. Corn which I brought from Vienna, in Austria, in 1845. This is the corn used for making bread at Vienna. It comes from the province of Bana in Hungary.

No. 12. Corn in small, unequal and hardened red grains.

No. 13. Corn given to me by M. P. D'Arblay, as being very common in the Paris market. It is a mixture of tender and hard corn.

No. 14. Very hard corn given to me by M. P. D'Arblay, as likewise very common in Paris.

The cellulose and ashes are to be deducted from the starch for Nos. 3, 5, 6, 11 and 12; the cellulose is to be deducted for Nos. 4, 8, 10 and 13.

In 100 parts.	I. White Flemish Wheat.	II. Hardy White.	III. White Touzel of Provence.	IV. Polish Odessa.	V. Hedge-hog wheat.	VI. Red Pollard.	VII. Conical blue Pollard (average year).	VIII. Conical blue Pollard (very dry year).	IX. Mitadin of the South.	X. Polish corn.	XI. Corn from Hungary.	XII. Egyptian corn.	XIII. Spanish corn.	XIV. Corn from Tangarock.
Water	14·6	13·6	14·6	15·2	13·2	13·0	14·4	13·2	13·6	13·2	14·5	13·5	15·2	14·8
Fatty matters	1·0	1·1	1·3	1·5	1·2	1·0	1·0	1·2	1·1	1·5	1·1	1·1	1·3	1·9
Nitrogenous matters insoluble in water	8·3	10·5	8·1	12·7	10·0	8·7	13·8	16·7	14·4	19·8	11·8	19·1	8·9	12·2
Soluble nitrogenous matters (albumen)	2·4	2·0	1·8	1·6	1·7	1·9	1·8	1·4	1·6	1·7	1·6	1·5	1·8	1·4
Soluble non-nitrogenous matter (dextrine)	9·2	10·5	8·1	6·3	6·8	7·8	7·2	5·9	6·4	6·8	5·4	6·0	7·3	7·9
Starch	62·7	60·8	66·1	61·3	67·1	66·7	59·9	59·7	59·8	55·1	65·6	58·8	66·6	57·9
Cellulose	1·8	1·5	,,	,,	,,	,,	1·5	,,	1·4	,,	,,	,,	,,	2·3
Salts	,,	,,	,,	1·4	,,	,,	1·9	1·9	1·7	1·9	,,	,,	1·4	1·6

ON THE EXISTENCE OF IODINE IN BEET-ROOTS.*

BY M. CH. LAMY.

SINCE the period of its discovery, iodine has been found, in the state of alkaline iodide, in very various circumstances. Thus, it has been found in the water of different seas and in many saline springs.† Vauquelin, Del Rio, and Bustamente, discovered it in various argentiferous ores of Mexico; Ynestra, in an agave (sabila) and a kind of barilla of Mexico; M. Bussy (see THE CHEMIST, No. X., page 443), in the products of the combustion of coal and in the condensed water of coal-gas; L. Gmelin, in cod-liver oil; Muller, in cress; and lately, in verifying the observation of the last-named chemist, M. Chatin in fresh water plants (see THE CHEMIST, No. VIII., page 352); finally, M. Personne proved the existence of iodine in the *Jungermania pinguis*, L. (see THE CHEMIST, No. IX., page 405), gathered in a little rivulet of Morvan, and M. Meyarc, in the Oscillariæ (*Anabaina thermalis, Oscillaria gratelupi*) which live in the thermal waters of Dax (Landes).

So many various sources of a body so important as iodine having been discovered, I thought it would not be uninteresting to make known how I proved its presence in beet-roots from the Grand-Duchy of Baden.

In November last, I received from M. L. Lintz, formerly student at the central school, the chemist attached to the sugar manufactory of Waghaüsel (Grand-Duchy of Baden) a sample of beet-root potassa; he advised me to examine it, thinking that it contained iodine, but was unable to give me any further information.

A small portion, dissolved in distilled water and saturated with a little nitric or sulphuric acid, gave me, after saturation, a liquor of a yellow color, exhaling a slight odor of iodine; on the addition of a small quantity of a solution of starch, it assumed an intense blue color, which disappeared by heating and reappeared by cooling—characteristics of iodide of starch.

After having repeated this test a great number of times, and being certain of the presence of iodine, in the state of alkaline iodide, in the potassa of Waghaüsel, I successively examined the various products of the manufacture of sugar in that locality, to which I was sent, in 1849, by the Society of Encouragement, to study the processes of extracting sugar from dried beet-roots.

I proceeded to examine various samples which I collected on this journey, following the inverse order of the manufacture of sugar, that is to say, commencing with the saline matter, the molasses, then taking the raw sugar, the beet-roots cut into small parallelopipeds and dried.

The saline matter was exhausted with warm water; the aqueous solution was evaporated to dryness, redissolved in concentrated alcohol, and again evaporated to dryness, and the residue divided into two portions: one portion was treated by sulphuric acid, then with a solution of starch; the other was tested by M. Alvaro Reynoso's process (see THE CHEMIST, No. I., page 15): the presence of iodine was manifested in both cases.

The ashes of the molasses were boiled with distilled water; one portion of the filtered liquor, saturated with nitric or sulphuric acid, gave me, like potassa, a beautiful blue color, by the addition of a solution of starch. The other portion, abandoned to spontaneous evaporation, left a crystallised residue which was treated with heat, with alcohol at 40 degrees, in order to dissolve the iodide and to separate it from the foreign salts insoluble in that vehicle. The alcoholic solution was evaporated to dryness, and the residue, redissolved in water, gave a solution which assumed a deep blue color with fecula. This coloration, which was very permanent, disappeared on heating the liquor and reappeared on cooling.

The same treatment was pursued with the refined sugar and the raw sugar, which did not give the slightest trace of iodine; the parallelopipeds, on the contrary, showed the presence of that body. The experiment was repeated several times, and always with the same results.

Thus, iodine, which exists in beet-roots, remains in the lowest products, and finally is found in the saline matter furnished by the combustion of the molasses and in the salt of potassa arising from the lixiviation of this saline matter.

I made comparative experiments on potassa and parallelopipeds of beet-roots from a sugar manufactory in the environs of Valenciennes; I found *no trace* of iodine.

Is the presence of iodine in the beet-roots of Waghaüsel due to an assimilation of the salts contained in the iodurettes salt-springs, so common in Germany, which issue from the lands where these roots are cultivated? This opinion I give only with reserve.

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* *Journal de Pharmacie*, July, 1850.

† M. O. Henry has also detected the existence of iodine in the sulphurous waters of Cauterets and in the barègine of some of the springs of the chain of the Pyrenees (Eaux Chaudes, Barèges, Cauterets).

Moreover, it is probable that all the beet-roots which are treated in the Sugar Manufactory of Waghaüsel do not contain iodine, seeing that this manufactory, which is fitted up on an extensive scale, operates annually on 50,000,000 kilogrammes (45,000 tons) of beet-roots supplied by 142 different communes, situated in a very extensive radius. Such varied sources lead one to think that the presence of iodine should be, so to speak, entirely local, if this body has the origin I have indicated.

To elucidate the question, it would be necessary to have at disposal a very considerable average sample of beet-root, and, moreover, samples of beet-root cultivated in such and such localities, which should be stated. An endeavor should likewise be made to estimate the iodine and thus to ascertain whether this body is in sufficiently important proportion to be extracted on the large scale: I intend to examine this further.

ON THE ACTION OF BASES ON SALTS, AND ESPECIALLY ON THE ARSENITES.*

BY SENOR ALVARO REYNOSO.

It is generally considered that, when a salt whose oxide is insoluble is treated by an alkaline solution, this oxide is precipitated without being redissolved; at any rate that in the free state it is not soluble in an excess of alkali with which the salt which contains it has been put in contact.

In studying the action of potassa and soda on the arsenites, I have been led to observe certain facts, which, if they are not precisely contrary to the general rule which I have just quoted, prove, at least, that this phenomenon of precipitation is sometimes intimately connected with the nature of the supernatant salt in which the precipitate exists; so that, in certain cases, this salt might determine the solubility of the oxide.

Thus, for example, the oxides of copper, uranium, cobalt, nickel, silver and mercury, and sesquioxide of iron, being insoluble in potassa and soda, when potassa or soda is poured into the arsenites of these bases, there should be simply a precipitation of insoluble oxide, and formation of arsenite of potassa or soda, without an excess of alkali exerting any action on the oxide. However, I have found that the arsenites of all these oxides are completely soluble in potassa, although in the free state these oxides are insoluble in it.

Arsenite of iron is very soluble in potassa.

The solution of arsenite of copper is blue, and decomposes after a certain time into protoxide of copper, which precipitates, whilst the arsenite of potassa passes into the state of arseniate.

The decomposition of the solution of arsenite of mercury is almost instantaneous. The solution of silver is colorless, and is very slowly decomposed, precipitating the silver as a black powder. This solution does not precipitate with chloride of sodium; on the contrary, the chloride of silver, which is insoluble in potassa, very readily dissolves in it when arsenite of potassa is added.

I profited by these two properties of arsenite of silver to effect the reduction of the salts of palladium by means of silver. The following is the mode of experimenting:—chloride of palladium, to which arsenite of potassa has been previously added, is poured into the solution of arsenite of silver in potassa. A precipitate of a black powder is speedily formed, which contains metallic silver and palladium. Chloride of platinum is reduced much more quickly than chloride of palladium. It is to be remarked that, in these reactions, the arsenite of silver is dissolved sooner than when it is alone.

The arsenites of cobalt, nickel and uranium are completely dissolved in potassa and soda only in the nascent state. To that end, arsenite of potassa with a great excess of potassa must be used, and the solution must be poured into a soluble salt of cobalt, nickel or uranium.

These reactions may easily be comprehended, by admitting that the arsenite of potassa may form, with the combination of potassa with these oxides, a soluble double salt, and that it is under this influence that their solution is determined. When potassa is made to act on an insoluble salt whose oxide is itself insoluble in an excess of potassa, it can be dissolved only by the formation of a double salt. Thus, for example, I have proved that arsenite of lead is insoluble in potassa. The proof that these reactions depend on the nature of the salt formed is, that the arsenite of lead, which is insoluble in potassa, is soluble in soda.

When potassa is poured into an insoluble salt, it removes the acid, and the oxide, set at liberty, will remain without action on the salt formed, for it is insoluble; but if an excess of potassa be added, and if the oxide be soluble in it, then, if the combination of this oxide with potassa cannot combine with the supernatant salt, we shall have two soluble salts together, which, being capable of forming an insoluble salt, by their decomposition will regenerate the original

* *Comptes Rendus*, No. 3, 15 July, 1850.

salts. However, this case is the rarest, for experience has proved that almost all the salts of potassa have the property of forming a soluble double salt with the oxides soluble in potassa.

For ammonia, I proved the solution of arsenite of sesquioxide of iron.

In conclusion, there may be four cases in the action of an excess of potassa on insoluble salts.

1. Certain oxides soluble in the free state in potassa, and forming soluble double salts with all the salts of potassa, solution may be observed in all circumstances.

2. At other times, oxides soluble in potassa in the free state, will form salts insoluble in potassa when the acid is of a nature not to form a soluble double salt with the combination of the oxide with potassa.

3. Other oxides, insoluble in the free state, in potassa, will nevertheless sometimes form a soluble double salt, and, consequently, dissolve when put in contact with potassa in the nascent state, in presence of the salt of potassa with which they can combine.

4. When the oxide is insoluble in the alkalis, it is precipitated, without redissolving, when the salt which contains it is treated by an excess of alkaline base. The latter case occurs when the precipitated oxide cannot form a soluble double salt.

ON ARIDIUM, A NEW METAL.*

BY M. ULLGREN.

A PAPER by M. Ullgren has been recently communicated to the Academy of Sciences at Stockholm by Professor Wallmark, giving an account of a supposed new metal occurring in the chrome iron of Röros, and some other iron ores. As the metal exhibits in its oxides great resemblance to iron, it has been named *aridium*.

In some experiments made with the view of detecting the presence of phosphorus in the bar iron of Oernstolos iron ores, the author found that the solution of iron obtained behaved in several respects differently towards reagents from one of iron only. Subsequently, in an examination of the chrome iron of Röros, he found that the peroxide of iron separated from it behaved like that in the first-named solution.

The powdered chrome ore was digested with hydrochloric acid, the greenish-yellow solution evaporated to dryness, the silica separated in the usual manner, and sulphuretted hydrogen passed through the solution to perfect saturation. A very small quantity of a greyish-yellow precipitate was obtained, consisting chiefly of sulphur. In order, however, to be certain of separating every metallic sulphuret insoluble in an acid liquid, the solution was neutralised with caustic potassa, mixed with sulphuret of potassium, then enough hydrochloric acid was added to dissolve the black precipitate that was formed. There was an inconsiderable pale yellow residue, and the solution was of a beautiful green color, proceeding principally from the oxide of chromium extracted from the chrome iron ore by the hydrochloric acid. The solution was then heated with chlorate of potassa and an excess of hydrochloric acid, and then precipitated with potassa at a boiling temperature. The alkaline liquid was yellow, and contained chromic acid and alumina; the precipitate was brownish-yellow; it was dried, rubbed to powder, and fused in a platinum crucible with a readily fusible flux and chlorate of potassa. When the fused mass was exhausted with water, only chromic acid and some alumina could be detected in the yellow solution. The presence of the latter induced the author again to dissolve the liver-colored residue, in hydrochloric acid, to precipitate again with caustic potassa, and wash with boiling water. The washed brown residue was then dissolved in hydrochloric acid, the solution mixed with a sufficient quantity of acetate of soda, diluted and boiled. A light reddish-brown pulverulent precipitate was obtained, not bulky, flocculent or brown like peroxide of iron; manganese, lime, magnesia and a trace of zinc remained in solution. The precipitate was now dissolved in hydrochloric acid, and the solution saturated with caustic ammonia. The precipitate produced formed blackish-brown lumps, which when dry did not present a vitreous, but an earthy fracture. This precipitate was then treated in the following manner:—A portion was dissolved in hydrochloric acid, and the acid expelled by ebullition with an accurately measured quantity of sulphuric acid, and evaporated to dryness. The residue was a whitish-yellow mass, interspersed with crystalline scales, still moist with the excess of sulphuric acid. It was dissolved in alcohol of 0·86 spec. grav., and 6 times the bulk of ether added to it. The liquid instantly became milky, and in the course of an hour the small eliminated drops collected in a thick syrup at the bottom of the vessel. The clear decanted liquid was again rendered turbid by the addition of ether. After expelling the ether and alcohol, a thick liquid remained, in which floated some blackish-brown flakes, not, as at first supposed, con-

* *Oversigt. af. Kongl. Vetensk. Akad. Förhandlinger*, No. 3, 1850.

sisting of an organic substance produced by the action of sulphuric acid on alcohol; for when burnt, they became greyish white, and gave with borax and microcosmic salt colorless beads, and a yellowish-grey opalescent bead with soda upon platinum wire. The liquid separated from these brown flakes deposited, on slow evaporation, after forty-eight hours, some small crystals cohering to verrucous masses, which were rinsed with alcohol, in which they are very sparingly soluble. These crystals are the sulphate of the peroxide of aridium.

Another portion of the same peroxide of iron, which had been used in the preceding examination was now heated to redness in a current of hydrogen until no more water was given off; the residue was treated with dilute nitric acid, in which a portion dissolved with disengagement of nitric oxide, which, however, soon ceased, when a black, somewhat brownish powder was left. This powder was magnetic, but the solution behaved like one of pure peroxide of iron. The powder was certainly an oxide, as it dissolved in hydrochloric acid without disengagement of gas. It was then packed into a charcoal crucible, covered with cyanide of potassa, and heated in the forge furnace. The powder caked together by this treatment, acquired an iron-grey color, interspersed with some small fused grey metallic granules. Dilute nitric acid dissolved a small portion with evolution of gas, but it soon ceased, and left a residue which dissolved no further in it. The portion dissolved by the nitric acid, in this and the preceding case, after the treatment with hydrogen, was peroxide of iron. The insoluble portion was now no longer magnetic, and dissolved in concentrated hydrochloric acid without disengagement of gas. This residue, therefore, like the protoxide of uranium, is a lower oxide of aridium, which cannot be further reduced in the charcoal crucible. The following is, as far as yet ascertained, the behavior of the oxide in question which justifies its being regarded as the oxide of a new metal:—

I. It dissolves in hydrochloric acid without disengagement of chlorine, and furnishes on evaporation at a gentle heat, a lemon-yellow deliquescent residue, which cannot be made to crystallise. It differs in this respect from the oxides of iron and cerium.

II. It gives a compound with sulphuric acid, which yields a colorless solution with water, differing from the persulphate of iron, at least in the presence of free acid. On ignition, this sulphate left a reddish-brown powder, which appeared under the microscope as small indistinct transparent crystals of a beautiful red color.

III. When sulphuretted hydrogen was passed through the solution of this metal, the oxide was reduced to protoxide. After expelling the excess of sulphuretted hydrogen, it was precipitated of a greyish-white color by ammonia; but this precipitate immediately became light brown, and not through green into brown as with protoxide of iron.

IV. The fresh solution of the protoxide is precipitated by ferrocyanide of potassium of a pale whitish-green color, which gradually changes into dark green, and afterwards becomes blueish. If an excess of ammonia is poured over it it becomes of a beautiful blue; but this color gradually disappears, and it finally turns greyish blue.

V. A solution of the protoxide of aridium is not precipitated by an infusion of galls. Acetate of soda gives a pale red precipitate.

VI. A solution of the peroxide of aridium does not strike a black, but a dark indigo-blue color with an infusion of galls, and furnishes upon the addition of acetate of soda a brownish-violet precipitate. Neither iron nor cerium behave in this manner.

VII. A solution of the peroxide of aridium gives a dark blue precipitate with ferrocyanide of potassium; but an excess of the precipitate changes the color into a dirty blueish green. Cerium give a white precipitate.

VIII. A solution of oxide of aridium is colored blueish green by the ferridcyanide of potassium, and deposits in the course of an hour, in the dark, a precipitate of the same color. A solution of peroxide of iron is colored brown; cerium is not precipitated.

IX. A solution of the peroxide of aridium is not precipitated, like a solution of iron, of a deep blood red by acetate of soda, but dark yellowish brown.

X. A solution of the peroxide of aridium strikes a deep red color with sulphocyanide of potassium, like a solution of the peroxide of iron; but in the case of iron the color disappears with an excess of acid, whilst with the peroxide of aridium it remains, even with a large excess of acid.

XI. A solution of the peroxide of aridium gives a light brownish-yellow precipitate and a yellow solution with carbonate of soda; peroxide of iron, on the contrary, gives a brownish-red precipitate, which also dissolves with a red color.

XII. The alkaline sulphurets produce a blackish-green precipitate, and the solution continues long green. The precipitate dissolves readily in dilute nitric acid.

XIII. Solutions of the oxide of aridium furnish with caustic alkalies precipitates like those produced in solutions of the peroxide of iron, only they are [illegible]

yellower, and more earthy when dried. After ignition, the powder is greyish brown, and not so red as the peroxide of iron.

XIV. Before the blowpipe, oxide of aridium gives with borax, on platinum wire, in the outer flame, a yellow bead which becomes colorless on cooling with small quantities. In larger quantities, the bead is of a brownish red; on cooling, yellow and opalescent, but not as with cerium. In the inner flame, the bead is colored of a light green by small quantities, and becomes colorless on cooling; with a larger quantity, the bead is of a beautiful green while hot; the purity of the color decreased as it cooled.

With microcosmic salt and strong saturation, the bead while hot was dark red in the outer flame, and perfectly colorless when cold. In the inner flame, the bead with a small quantity was colorless; with a large quantity slightly brown when cold.

The mass fused with soda upon charcoal to a glass, which was absorbed by the charcoal, but did not furnish any metallic particles on being subsequently triturated in a mortar. On platinum wire with soda, a reddish-brown transparent glass was obtained while hot, which on cooling became spotted with brown. In the inner flame, a glass was formed, which remained perfectly colorless. and in which no precipitate was perceptible. On heating the bead in the outer flame, the previous reaction appeared.

THE DECOMPOSITION OF CHLORIDE OF SODIUM BY ACETIC ACID IN THE PRESENCE OF ALBUMEN, OR THE COAGULATION OF THE ALBUMEN OF THE SERUM IN THE PRESENCE OF ACETIC ACID AND A CERTAIN AMOUNT OF CHLORIDE OF SODIUM.*

BY DR. E. A. PARKES, PROFESSOR OF CLINICAL MEDICINE IN UNIVERSITY COLLEGE, AND PHYSICIAN TO UNIVERSITY COLLEGE HOSPITAL.

I HAVE been unable to find any notice of some facts which I have lately observed, and which are of interest in a chemical point of view, and possibly also may have physiological and pathological applications.

If the undiluted serum of the blood be strongly acidified with acetic acid, no change results, or a very slight haze is produced. If large fragments of chloride of sodium are now dropped into this fluid, the following changes occur. Almost immediately the sharp angles of the salt disappear, the fragment increases in size, and becomes rounded in form, from the deposit upon its surface of a coating of albumen. Slight agitation dissolves both the coagulum and the salt, and the serum becomes as before, perfectly clear. If the particles of salt are very small, the solution occurs so rapidly, that the albuminous deposit can scarcely be observed. The addition of a little more salt re-induces the same phenomena of deposit of albumen and subsequent re-solution. After a certain amount of salt has been added, the serum becomes incapable of dissolving the albuminous precipitate; and this condition of things occurs, provided the acidity be considerable, when the percentage of the chloride of sodium is very moderate. The albumen thus precipitated is not affected by acetic acid, or by caustic potassa, added at once to the solution, but is soluble in water. If chloride of sodium be now added to saturation, the whole of the albumen is thrown down, and the liquid, which can be filtered off the precipitate, gives no indication of albumen, or the very merest trace. The filtering is more readily accomplished, if the fluid be diluted by adding a little strong solution of chloride of sodium, or, what is the same thing, a little water, not sufficient to dissolve the excess of chloride of sodium which has been added.

The explanation of these changes appears to be, either that in the first place the presence of another acid permits the hydrochloric acid to manifest the strong affinity it has for albumen, which consequently coagulates round each particle of salt; and, secondly, that the compound thus resulting, which is so soluble in water, is perfectly insoluble in a moderately strong solution of chloride of sodium, or it may be supposed that the combination of acetic acid and albumen, which is soluble in water (like the combinations, under certain conditions, of hydrochloric and nitric acids with albumen), is insoluble in solution of chloride of sodium of a certain concentration. The first explanation appears more probable, but some experiments, which need not be detailed now, on the action of acetic acid on serum, apart altogether from the influence of hydrochloric acid, or of chloride of sodium, support, in some measure, the last supposition.

The rapidity and perfection with which these changes occur depend upon the strength of the acid, and upon the quantity of chloride of sodium, and possibly, also, may be affected by the percentage of albumen; although I am not at present able to speak perfectly on this last point. The amount of foreign acid present seems to be a very important point. If the quantity of acetic acid which is added, be so small as

* *Medical Times*, July 27th, 1850.

to give a just perceptible acid reaction, a good deal of salt dissolves without any precipitate; and it is not till a considerable amount has been added that the deposit occurs, and then apparently this is impartial and imperfect only; whereas, if the acetic acid be added in larger quantity, the deposit occurs at once, and the quantity of chloride of sodium necessary to be added is inconsiderable. Thus, some limpid serum, which analysis in the ordinary way proved to contain 66 per 1000 of coagulable matter, insoluble in alcohol and water, (after coagulation), being very feebly acidulated with acetic acid, nearly 24 per cent. of common salt was added before the liquid became very turbid, and then the turbidity, though manifestly greater than that which would have been produced by the salt alone,* was infinitely less than was produced by sharply acidulating the same serum, and adding only 5 per cent. of chloride of sodium.† It would, therefore, appear that, though a feeble acid may, under certain circumstances, cause the coagulation of the albumen, yet that a strong acid does so much more perfectly.

Chloride of sodium is not the only salt which causes, under the circumstances now noted, the coagulation of albumen. The chloride of potassium, as might be supposed, acts in the same way, so do the sulphates of potash and soda, the nitrate of soda, the sulphate of magnesia, and probably other salts. On the contrary, no precipitate can be obtained with acetate of potash and acetic acid. Other acids may be substituted for the acetic. Thus hydrochloric acid added to moderate acidity gives no precipitate; or, according to the strength of the acid, gives a precipitate which is redissolved, the addition of chloride of sodium immediately producing the albuminous deposit.

It is an interesting point that the common phosphate of soda, (2 atoms of fixed base) not only gives no precipitate by itself, or with acetic acid, but appears to a certain extent to dissolve that given by chloride of sodium. Thus, if phosphate of soda be first added to saturation,* and then acetic acid and the chloride of sodium, the proportion of the latter necessary for complete precipitation is greater than when no phosphate is present; yet no amount of phosphate of soda will prevent the coagulation when the chloride of sodium reaches a certain amount.

Whether these or analogous chemical changes occur in the animal system, and, if so, under what conditions, is a point on which it would be hazardous to express at present any opinion. It is very evident that the amount of chloride of sodium normally present in serum (viz., from 3 to 6 per 1000 parts) would not permit deposition from this cause even in the presence of the strongest acids; and that, if serum containing the whole of its salts and albumen were to exude into the tissues of the body which have so strong an acid reaction, and, although such normal acidity were heightened by the presence of a foreign acid, (as very possibly may be the case in various diseases), yet no coagulation of albumen, in the manner here supposed, could occur, so long as the serum remained in its ordinary state of dilution. At least this is to be concluded from such elements of the problem as are at present known to us. Yet it is equally evident, that, if such exuded serum could undergo concentration in any way, then (in spite of the dissolving influence of the phosphate of soda), with a rapidity and perfection proportioned to the

* The effect of chloride of sodium, and some other neutral salts, in producing, (when added to saturation) a white precipitate in the serum of blood, was first noticed by Dr. Buchanan, of Glasgow.—(Proceedings of the Glasgow Phil. Society, March, 1845). The precipitate thus produced is comparatively small in amount. Dr. Buchanan named this matter provisionally "pabulin," from the notion that it was immediately derived from food; but from an experiment on himself he afterwards concluded that it existed also in the serum, drawn after twenty-four hours' fasting. Although I have not yet succeeded in absolutely proving it, I think this substance is albumen; and, if so, it affords another instance of the remarkable influence of chloride of sodium on a strong solution of albumen such as exists in serum. A portion of albumen seems to be deposited when chloride of sodium is added in excess. A little water dissolves the precipitate, and the saturation of this water with salt again precipitates it. Some other salts, as sulphate of soda, act even more powerfully in this way.

† These rough numbers are, of course, merely given as examples, or approximative averages, to indicate the point in question. In the serum in question the amount of chloride of sodium normally existent in it was not determined, as the experiment was one merely of comparison.

* In all these experiments it is necessary to avoid adding water, as water itself produces specific changes on the albumen.

strength of the acid with which it was in contact, and to its own concentration it must inevitably coagulate. It is not difficult, with the observations of Liebig before us, to suppose that in certain tissues there may be a free acid, such as the lactic, capable of effecting such a transformation; but it is not so easy to conceive how serum, even supposing it to be poured forth, under the influence of pathological states, with the usual proportions of its component parts, could become concentrated. Whether the water could, in any way, diffuse away from the solids it previously held in solution, is a point which may possibly be hereafter cleared up by those extraordinary researches of Mr. Graham, which promise to throw so much light on various points in physics.

In some normal conditions, it is almost necessary to suppose that concentration of serum must occur from evaporation,—as, for example, in the case of the skin. If it could be proved that the serum exuded from the capillaries of the skin, (as is believed by many), and then, being concentrated by the vast loss of liquid from the surface, came in contact with an acid, as seems not impossible, considering the acidity of the perspiration, a more or less complete coagulation must necessarily result.

These are mere speculations, which I should not have brought forward, even in this guarded way, were it not that the universal diffusion of chloride of sodium, which points to some very important function, the ease with which, in the laboratory, albumen is deposited in its presence, under given conditions, and the singular alternation of acid and alkaline fluids, which is found throughout the economy, render it not impossible that the chemical facts, mentioned in this paper, may be worthy the attention of physiologists.

NEW MODE OF ESTIMATING TIN.*

BY M. CH. MÉNE.

HITHERTO, in chemical analysis, tin has always been estimated in the state of stannic acid. The difficulty of these manipulations, or, rather, the minute care they require, the time necessarily occupied in its preparation, washing, and desication, and at the same time the unavoidable inaccuracy of this process, often form an obstacle and an impediment to the analysis of this metal.

Having successfully employed a different mode of estimation, I have thought it my duty to communicate it to the Academy, and to submit it to the examination of chemists. This new method is based on the employment of a test liquor of known strength; it is sufficient to say, I think, that it has a simplicity, a rapidity, and an accuracy which cannot be attained in any other process.

The principle on which I have established my estimation of tin is based on the property which protochloride of tin possesses of removing chlorine from every body capable of yielding it. If, therefore, we pour a solution of perchloride of iron, a salt of a reddish yellow color, into protochloride of tin, a perfectly colorless salt, the salt of iron will give up to it, one equivalent of chlorine causing it to pass to the state of perchloride, a colorless salt, and will remain in the liquor in the state of protochloride, also a colorless salt.

$$Fe^2Cl^3 + Sn\,Cl = 2(Fe\,Cl) + Sn\,Cl^2$$

The decoloration of the salt of iron should therefore take place so long as the salt of tin requires more chlorine; but, so soon as the protochloride is completely converted into perchloride, the least drop of the solution of the salt of iron will powerfully color the test-liquor, and will indicate the completion of the operation. If the solution of perchloride of iron be made of known strength, we know immediately the quantity of tin sought for.

This system of analysis is so much adopted in laboratories, that I may dispense with all details except those which relate especially to the analysis of tin.

For that purpose, 1 or 2 grammes of the matter to be analysed are introduced into a matrass of the capacity of a pint, with a mixture of 1 part of nitric acid, and 6 parts of hydrochloric acid, it is vividly attacked by boiling for a short time, or better until the liquor assumes a yellow color and has a powerful odor of chlorine. The tin is now dissolved in the state of perchloride. Zinc is then added until the liquor becomes clear, colorless, and limpid. The zinc, in dissolving, causes the tin to pass to the state of protochloride; that is to say, it precipitates it in the metallic state, but the excess of hydrochloric acid immediately redissolves it, and retains it in the liquor in the state of protochloride. At this moment, with a graduated burette, the solution of perchloride of iron of known strength is added until a slight color appears, and the proportion of tin is determined by a simple calculation.

It is useful to add to the liquor to be treated a certain quantity of water, especially in operating on alloys which contain copper.

* *Comptes Rendus*, No. 4, July 22, 1850.

When a mixture of tin and other metals, as copper, lead, &c., that is to say, of matters little or not at all attacked by hydrochloric acid has to be analysed, the zinc, as above, decolors the liquor and precipitates them all in the metallic state, and their particles collect at the bottom of the vessel and do not prevent the operator from seizing the moment of final coloration. When, on the contrary, metals which are attackable by hydrochloric acid, as iron, &c., are present, they remain in the liquor in the state of protochloride and do not cause any inconvenience, since their affinity for chlorine is less than that of tin and protochloride of iron.

Arsenic alone makes an exception to the rule, therefore it is necessary to subject the matter to be tested to a preliminary operation. It is sufficient, when tin is contaminated with this metal, to heat it very powerfully for some time in a crucible; the arsenic then volatilises, and the tin, left alone with the fixed metals, dissolves in a mixture of the acids, as I have already pointed out.

Finally, the earthy bases, as lime, baryta, and alumina, do not impede this process.

In conclusion I may point out a convenient and short process for procuring the perchloride of iron: it is important, indeed, not to use a salt which contains the slightest trace of free nitric acid, for otherwise, in analysing the alloys of tin, it would act on the other metals, oxidise them, and inevitably cause errors. To prepare perchloride of iron, I employed, advantageously, peroxide of iron, or, better still, colcothar, which I boiled for about ten minutes with pure hydrochloric acid, and which I filtered immediately.

This liquor does not alter and may be preserved indefinitely. The perchloride of iron may be crystallised by concentration and cooling; but the loss which is experienced, and the variable and accidental products which are formed, and especially the uselessness of this precaution, lead me not to recommend the employment of this salt in crystals.

To make a solution of perchloride of iron of known strength, it is almost needless to say that we should weigh out exactly one gramme of tin, ascertain what number of divisions on the burette is required for the perchloride, and compare it by calculation with the results of analysis.

The employment of these modes of estimation is so simple and so familiar to chemists, that I need not give fuller details.

CHEMICAL EXAMINATION OF A MINERAL CONTAINING OXIDE OF URANIUM FROM THE NORTH SHORE OF LAKE SUPERIOR.*

BY J. D. WHITNEY.

THE specimen of which the analysis follows, was given me by J. W. Forster, Esq., and is the same mineral which has been named *Coracite* by Mr. J. L. Le Conte, and partially described by him in the American Journal of Science, (New Series, vol. iii. p. 174). As it is evident that the conclusions drawn by Mr. Le Conte from his qualitative examination were quite incorrect, and as the mineral differs considerably in its reaction with acids, from pitchblende, with which it has the greatest analogy, and which at first sight it would seem to be, I have carefully examined it, with the following results:—

Substance amorphous; fracture uneven; without cleavage; hardness 3; spec. grav. —; color pitch black; powder gray; lustre resinous.

Before the blow-pipe it does not change its appearance, or fuse, or color the flame. It gives with the fluxes the characteristic reaction of uranium.

It dissolves readily without the application of heat in dilute hydrochloric acid, effervescing strongly; in which respect it differs entirely from pitchblende, which is insoluble, except in nitric acid or in aqua regia. It gives a beautiful green solution, a small quantity of flocky silica separating.

The analysis was conducted as follows:—

A portion of the mineral, carefully selected and freed from foreign matters, was pulverised and dried at 212° F. It was then dissolved by hydrochloric acid in a suitable apparatus, the loss of weight being considered as carbonic acid. The silica separated by filtration was found to be pure when tested by the blow-pipe, and was entirely soluble in carbonate of soda. In the solution filtered from the silica, sulphuretted hydrogen threw down a precipitate, at first dark brown and afterwards black, of sulphuret of lead, which was estimated as sulphate of lead by oxidising with nitric acid. The filtered solution was then digested till it no longer smelt of sulphuretted hydrogen, and oxides of uranium and iron and alumina precipitated by caustic ammonia. The precipitate was washed with water, to which chloride of ammonium had been added, and then taken moist from the filter and redissolved in

* *Boston Journal of Natural History*, vol. vi. p. 37.

hydrochloric acid. In this solution oxide of iron and alumina were precipitated by carbonate of ammonia, the oxide of uranium remaining in solution, and care being taken that the solution should be quite dilute, in order that the iron might be entirely precipitated. The oxides of iron and alumina were separated by caustic potassa. In the solution filtered from these sub-tances, the uranium was precipitated by adding hydrochloric acid to supersaturation, boiling to expel all the carbonic acid, and then adding ammonia. In the solution from which the precipitate by ammonia of uranium, iron and alumina had been separated, the lime was thrown down by ammonia and oxalic acid. The filtered solution was evaporated to dryness, and the ammoniacal salts driven off by ignition, when there remained traces of magnesia and manganese.

The water was estimated by ignition in a bulb-tube, and collecting the water driven off in a weighed chloride of calcium tube. The mineral does not however part with any of its carbonic acid at a temperature below that required to drive off all the water; nor is it rendered less soluble by exposure to the strongest heat of a Berzelius lamp.

No traces of sulphur could be found by boiling the mineral with fuming nitric acid, and testing with chloride of barium. The lead has therefore been calculated as oxide, and not as a sulphuret.

The per-centage results of two analyses are as follows:—

	I	II
Silica	4·35	5·60
Alumina	0·90	3·64
Oxide of iron	2·24	
Oxide of uranium	50·30	57·54
Oxide of lead	5·36	5·84
Lime	14·44	13·47
Carbonic acid	7·47	
Water	4·64	
Magnesia and manganese	traces	
	98·70	

That the uranium exists in the mineral as U^2O^3, and not as UOU^2O^3, as in the common pitchblende, is evident from its ready solubility in acids; and that the oxide of uranium, or uranic acid as it might with equal propriety be called, is in chemical combination in the mineral is equally evident from the fact that its solubility is not diminished by ignition. That the silica is also chemically combined is shown by the fact that it is separated in a state in which it is soluble in carbonate of soda. It is difficult to see in exactly what manner these elements are combined with regard to each other, though it is probable that the oxide of uranium plays the part of an acid towards a portion of the lime (the remaining portion being in combination with the carbonic acid) and the lead. The frequent occurrence of a small quantity of oxide of lead with the ores of uranium is an interesting fact, on which future investigations may perhaps throw some light.

ON THE ALKALINITY OF THE SERUM OF THE BLOOD.*

Mr. Cohen, in a memoir presented to the national academy of medicine, has lately established the following propositions:—

In the healthy state, the circulating serum holds in solution the substance which will ultimately be divided into albumen and fibrine.

Albumen and fibrine may be artificially transformed the one into the other.

Fibrine cannot exist in the presence of a liquid containing a weak solution of soda at a temperature of 104° F; it is then transformed into albumen or at least remains in a state of solution.

In inflammatory maladies, the fibrine of the blood is augmented, the albumen is diminished,

The augmentation of the fibrine is equal to the diminution of the albumen.

The addition of a small quantity of soda renews the original proportions.

In phlegmasia the serum is less alkaline than in the normal state.

The augmentation of the fibrine in phlegmasia is due to the diminution of the free soda of the serum.

ANALYSIS OF THE ASHES OF THE BLOOD.†

BY M. G. ROSER.

M. Roser has made some analyses of the ashes of blood which before incineration had been coagulated and washed with cold water, or boiling water, or with cold water and then with alcohol and ether. The ashes thus obtained necessarily differ in their composition from ashes of blood not exhausted by these vehicles, but incinerated in a mass, and which are termed normal ashes. A greater proportion of iron is found in the ashes of exhausted blood than in normal ashes, whilst precisely the reverse is observed with regard to phosphoric acid. The lixiviated ashes contain scarcely a sufficient

*Journal de Chimie Medicale, Aug., 1850.
†Journal de Pharmacie et de Chimie, July, 1850.

quantity of this acid to form tribasic phosphates with lime and magnesia. M. Roser draws from these facts the very just conclusion that iron is not contained in the blood in a state of combination with phosphoric acid.

PYROGLYCERINE.*

Signor Sobrero has given this name to a product which he obtained by treating glycerine with a mixture of nitric and sulphuric acids in the same proportions as for the preparation of gun-cotton.

Pyroglycerine is liquid, slightly bitter, very poisonous, for a dose of from 2 to 3 centigrammes will kill a dog instantly. It is a powerful oxidising matter, which, when mingled with nitric acid will even form a sort of aqua regia.

It detonates very violently.

Signor Sobrero has not hitherto been able to analyse it; but he thinks that it contains nitric acid.

*Journal de Chimie Medicale, July, 1850.

ON THE BERRIES OF MYRTUS COMMUNIS.*

BY DR. E. BIEGEL.

The distillation, with water, of fresh ripe berries of *Myrtus Communis* produced from 25 to 30 grs. of an essential oil, similar to that obtained from the leaves of this plant. The residue was exhausted with alcohol, evaporated to an extract, and treated with ether; a greenish brown resin was obtained. The ether being evaporated left a soft resin of pungent taste, soluble in alcohol. That portion of the alcoholic extract which was insoluble in ether contained tannin and sugar; the part of the aqueous extract insoluble in alcohol contained citric and malic acids, mucilage, and substances resembling humic acid, potassa and lime.

* *Archiv der Pharmacie.*

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

CHEMICAL ANALYSIS OF HUMUS, AND ON THE PART PERFORMED BY MANURES IN THE NOURISHMENT OF PLANTS.*

BY E. SOUBEIRAN.

(Concluded from page 457.)

SECOND PART.—ANALYSIS OF SOME MANURES.

This second part of my memoir, in which I give the composition of some manures, is less intimately connected with the programme of the Society; still it is by no means unconnected with it. A manure is, indeed, a compound aliment, each element of which contributes to the same end—the nutrition of plants. Humus enters into it as a real alimentary matter; but, in addition, it receives the influence of the substances which accompany it, either as they contribute to its production, or as they communicate to it that state of solubility without which they cannot be absorbed.

This second part of my work, which seems to be susceptible only of a practical and special application, has, however, acquired a more general interest. I have shown that, by making use of a bad method of determining nitrogen, faulty analyses and an incorrect table of equivalents have been arrived at. I show also that the state in which nitrogen is found in manures has not been sufficiently taken into consideration, since it is by no means a matter of indifference whether it exists in them in the state of putrescible animal matter or of ammoniacal salts, of soluble ammonical salts or of ammoniaco-magnesian phosphate. This difference was once made, by M. Jacquemont, in the analysis of powdered human dung, but a defect in the analysis led him to draw from it erroneous conclusions.

I show, moreover, that to represent the value of a manure by the amount of nitrogen it contains is a serious error, and that the equivalents established on this principle are by no means equivalents. I rely on the necessity of taking into account the saline matters, the ammoniacal salts and their peculiar constitution, the animal matter,

* *Journal de Pharmacie et de Chimie*, July, 1850.

and its more or less alterable nature. I have already said how important the presence of humus, an essentially preservative body, is for moderating the decomposition of putrescible matters, for improving the physical conditions of the soil, for fixing the ammonia, and for furnishing to the plant a substantial nutriment.

The manure which theory indicates as the best is that which contains at once a certain quantity of soluble salts, earthy or alkaline, of ammoniacal salts, of nitrogenous animal matter—which by its slow decomposition gives daily a certain portion of carbonate of ammonia—of humus ready formed, and of vegetable tissue in course of transformation. All these principles are united, better than in any other, in fermented farm-yard manure. These give it an indisputable superiority over all manures.

In the analysis of manures, therefore, three principal elements have to be determined, namely :—The proportion of humus or of matter capable of forming humus; the nature and the proportion of the salts; and the proportion of the nitrogenous matter.

Before giving the composition of the manures which I have submitted to analysis, I will describe in a general manner some parts of the processes which I have used.

DETERMINATION OF NITROGEN.

The determination of nitrogen relates to the nitrogen of the animal matter, and to that of the ammoniacal salts. The first is estimated by Varrentrapp and Will's method, substituting, if desirable, the saturation of the acid for the determination of the ammonio-chloride of platinum.

The nitrogen of the ammoniacal salts requires that we should distinguish that which arises from the soluble salts, which may be extracted by simple washing, and that which forms part of the ammoniaco-magnesian phosphate, a very sparingly soluble salt, and, consequently, well adapted for remaining in the soil, and for absorption by the plant only by degrees, and in proportion to its wants. The experiment should therefore be made in the first instance on the washing waters of the manure, whilst, in another experiment, the washed manure should be put in contact with water acidulated with nitric acid, so as to dissolve out the ammoniaco-magnesian phosphate. For the rest, the treatment will be the same for each of the two liquors. The determination of the nitrogen of the ammoniacal salts in the powdered human excrement of Montfaucon may be taken as an example.

The first experiment showed that 100 parts of poudrette (powdered human excrement) lose 28 parts of water at 212° F.

100 grammes of poudrette was put into a tared vessel and wetted with sufficient water to form a soft paste; then nitric acid is added by degrees until the liquor remains powerfully acid after twelve hours' contact. Then water is added to make up 400 grammes of liquid, namely: water of poudrette 28 grammes; nitric acid and water, 372 grammes; it is agitated and allowed to deposit. 100cc. of this liquor represent 25 grammes of poudrette.

200 grammes of liquor are put into a graduated test tube; a concentrated solution of neutral acetate of lead is added until precipitation ceases: sufficient water is added to make up 300cc. It is filtered to extract from it 200cc., which represent 33·3 of poudrette. Into this liquor is poured a concentrated solution of carbonate of potassa, in such quantity that the liquor acquires a very powerful alkaline reaction; a white precipitate is formed. The whole, liquor and precipitate, is introduced into a tubulated retort, of which it should occupy two-thirds. The retort is so arranged as to be heated with a spirit lamp. Its neck is introduced into a test glass containing 10cc. of hydrochloric acid of known strength and which does not fume, diluted with 8 or 10 times its volume of water. The neck of the retort dips into the acid, so that no bubble can be disengaged without passing through it. When the operation approaches its termination, care must be taken that the neck of the retort shall enter only a very little way into the acid liquor; in this manner, when the vacuum forms, the liquid rises a little way into the neck, but a bubble of gas very soon forces it out and re-establishes the equilibrium.

The employment of a spirit lamp affords an easy means of regulating the ebullition. After half an hour, the liquid in the retort is completely freed from ammonia. Then the retort is detached from the test tube, care being taken not to allow any portion of acid to be lost. The neck of the retort is dipped into a vessel containing a little water. This water rises into the neck as the retort cools, and when it has reached the height to which the acid rose during the distillation, the retort is raised so as to allow the air to enter. This is repeated three times with fresh water, and, after mixing all the liquors, sufficient water is added to make up 500cc.

50cc. of this liquid are put into a glass vessel; a few drops of tincture of litmus are added, and the liquid is saturated by adding, drop by drop, by means of a Gay-Lussac's burette, a limpid solution of saccharate of lime of known strength. As only one-tenth part of acid has been em-

ployed, the number of divisions given by observation must be multiplied by 10. This acidimetrical liquor, which was proposed by M. Peligot, is extremely convenient, as it constitutes a solution of caustic alkali, whose saturating power is not affected by the atmosphere, and which possesses the advantage, over the carbonated liquors, of denoting, in the most striking manner, the point of saturation.

DETERMINATION OF THE PHOSPHATES.

I availed myself of Fresenius' method, coupled with that of Raewsky, for determining the proportion of the phosphates, for the ashes of manures almost always contain, in the state of mixture, a certain quantity of alumina and oxide of iron which render their analysis more difficult. But since this work has been published, I have ascertained by direct experiment that these processes give too small a product, for these reasons: Raewsky's process, because a little phosphate of alumina is always formed which the manganate of potassa does not detect, and Fresenius' process, because a portion of ammoniaco-magnesian phosphate remains dissolved in the liquors. It therefore results that in all the determinations the proportion of phosphates is found rather too small. Of all the processes hitherto published, none have given me entire satisfaction. A sure process for the determination of the phosphates has yet to be found.

It appears to me most convenient always to represent the phosphoric acid in the state of bone-phosphate. This is its ordinary state in the earth and in vegetables. Although the composition of this phosphate is not absolutely constant, it deviates very little from that of the phosphate $3CaO + PO^5$, found by Raewsky.

POUDRETTE (POWDERED HUMAN EXCREMENT) OF MONTFAUCON.

I am acquainted with only two analyses of the poudrette of Montfaucon. The first is that of MM. Boussingault and Payen, which states at 1·56 per cent. the quantity of nitrogen contained in humid poudrette (2·67 per cent. in dry poudrette); the other is the analysis of M. Jacquemont, who, estimating the nitrogen in the state of sulphate of ammonia, found that half, 3·6, exists in the state of ammoniacal salts, whilst the other half (3·26) forms part of the animal matter. The whole of the nitrogen would be 1·9. The salts would be especially phosphate of ammonia, phosphate of lime and carbonate of ammonia. The latter would constitute seven-eighths of the ammoniacal salts. There is here an evident error, originating in the mode of analysis followed by M. Jacquemont. He regarded as pre-existing in the state of carbonate of ammonia all the alkali disengaged while he heated the poudrette to from 482° to 572° F.; now this results in great measure, as I shall show, from a double decomposition between the carbonate of lime, which exists abundantly in poudrette, and the various ammoniacal salts.

I operated on poudrette which I took myself at Montfaucon, in the month of October, 1847, from a common heap, as the farmers' carts were being filled with it. This poudrette was still warm. It was put into a stoppered vessel, and operated on next morning.

A known weight was kept in an oven heated to 113° F., until it lost no more in weight. The loss, which may without any great error be regarded as arising from water alone, amounted to 28 per cent.

The poudrette of Montfaucon, in the state of humidity in which it was sold to consumers, contained, therefore, in 100 parts:

	Nitrogen.	Ammonia.
Animal matter	1·18	1·440
Ammoniaco-magnesian phosphate	0·36	0·440
Soluble ammoniacal salts	0·24	0·293
	1·78	2·173

Carbonate of ammonia enters only in very small proportion into the composition of poudrette.

It will be remarked that the quantity of nitrogen which I found in poudrette differs little from that indicated by MM. Boussingault and Payen; but the result of these chemists must be corrected, for they did not take account of the volatilisation of the carbonate of ammonia pre-existing in poudrette, nor of the portion of that salt which results from the double decomposition of the ammoniacal salts by carbonate of lime. I found a greater difference with regard to the water; but poudrette is very variable in this respect. MM. Boussingault and Payen found 41 per cent. I found 31 per cent. in some poudrette taken from a heap at Montfaucon, but at another time.

100 parts of dry poudrette leave 59·5 of ash (43 per cent. of humid poudrette). This ash contained, in 100 parts:—

Soluble alkaline salts	1
Carbonate of lime	9
Sulphate of lime	9
Phosphoric acid (in the saline state)	8

100 parts of ashes of the poudrette of Montfaucon resulted from 223 parts of fresh poudrette; these 100 grains contained 15·30 of ammoniaco-magnesian phosphate, containing 4·28 of phosphoric acid. Of the 8 parts of phosphoric acid, therefore, 4·29

per cent. arise from the ammoniaco-magnesian phosphate, and 3·72 from other phosphates, and which represent 8·1 of bone phosphate.

In conclusion, poudrette, in the state in which it was sold to farmers, on the 6th of November, 1847, was composed of—

Water	280·
Organic matter	290·
Soluble alkaline salts	4·3
Carbonate and hydrosulphate of ammonia	Not determined
Carbonate of lime	38·7
Sulphate of lime	38·7
Ammoniaco-magnesian phosphate	65·5
Phosphates estimated in the state of bone phosphate	34·6
Earthy matters	248·2
	1000·0

I have given above the relative proportion of the nitrogenous matters, which is very essential in the estimation of a manure, since they are far from possessing a similar mode of action. The soluble ammoniacal salts are promptly absorbed; but they run considerable risk of being in great measure carried away by the rain. The ammoniaco-magnesian phosphate has a favorable action which has been put beyond doubt by the experiments of M. Boussingault; it is due to its solubility, and to the slow decomposition, which, perhaps, the calcareous portions of the soil exert on it. The animal matter is not very abundant in poudrette; and its active decomposition commences only towards the month of May, a period at which the excitation produced by the poudrette shows fresh vigor. Poudrette is favorable to the views of Liebig, who attributes to the saline substances the greater part of the effects of manure; but it is deficient in an essential quality—durability of action. Vegetable organic matter is wanting. Thus, it cannot suffice for successive crops, and the land would soon be exhausted if farm-yard manure were not alternately employed.

FARM-YARD MANURE.

M. Philippar, one of the professors of the School of Grignon has been kind enough to send me a portion of manure taken from a heap which was about to be laid on the fields. This was a made manure, but which was still far from that advanced state of decomposition which agriculturists designate under the name of black butter. At Grignon, it is prepared by mixing the dung arising from the stables, cow-houses, sheepfolds and pig-styes. They are heaped up in a rectangular mass which is wetted from time to time with urine.

Dung loses, in the oven, 69·4 per cent. of its weight; 100 parts of fresh dung represent, therefore, 30·6 per cent. of dry dung, and 100 parts of dry dung result from 326 parts of fresh dung.

To estimate the quantity of nitrogen contained in the ammoniacal salts, 500 grammes of fresh dung were treated with water acidulated with nitric acid, namely:—

	grammes.
Water and acid	1,000
Water of the manure	347
	1,347

6,000cc. of this liquor, representing 222 grammes of fresh dung, were treated by acetate of lead; the whole of the liquor was brought to 800cc. The ammonia was sought by carbonate of potassa in 400cc. of this liquor, representing 111 grammes of fresh dung. Experiment gave: nitrogen, 0·257, or 0·231 per cent.

Ammonia was afterwards sought for in the washed manure. It gave of soluble ammoniacal salts 0·167 per cent. of dung.

The result is, therefore, in 100 parts of fresh dung:—

Nitrogen of the soluble ammoniacal salts	0·167
Nitrogen of the ammoniaco-magnesian phosphate	0·064
	0·231

To ascertain the proportion of nitrogen in the animal matter, 500 grammes of fresh dung were dried, and then treated with water, nitric acid, acetate of lead, &c. The quantity of nitrogen found amounted to 0·52 per cent. of dry dung.

The same dung was analysed with the mixture of lime and soda. It furnished, in 100 parts, 4·292 of nitrogen. Deducting the nitrogen of the ammoniacal salts, we have 4·292—0·52=3·772 for the nitrogen of the animal matter. In humid dung, this quantity is really only 1·16 per cent.

100 parts of farm-yard dung from Grignon, therefore, contained:—

Nitrogen of the animal matter	1·160
Nitrogen of the soluble ammoniacal salts	0·167
Nitrogen of the ammoniaco-magnesian phosphate	0·064
Total nitrogen	1·391

100 parts of fresh dung, containing, as I have said, 69·4 parts of water, 100 parts of dry dung left 40 parts of ash; then 100 parts of ash represent 250 parts of dry dung

and 791 parts of fresh dung. 100 parts of these ashes contained:—

Soluble alkaline salts	6·
Carbonate of lime and magnesia	12·
Sulphate of lime	9·
Phosphoric acid	4·2

100 parts of ash resulted from 791 parts of fresh dung, which contained 9·1 of ammoniaco-magnesian phosphate, which contains 2·54 of phosphoric acid. Of the 4·20 of phosphoric acid found in the ash, 2·54 resulted, therefore, from the ammoniaco-magnesian phosphate: the remainder, namely 1·66, represents 3·61 of bone phosphate.

The fresh dung from Grignon was, therefore, composed, in 1000 parts, of:—

Water	694·
Organic matters	192·
Soluble alkaline salts	8·75
Carbonate of lime and magnesia	17·50
Sulphate of lime	13·13
Ammoniaco-magnesian phosphate	11·50
Phosphates, principally phosphate of lime	4·65
Earthy matters	66·47

The quantity of nitrogen is 13·36, thus divided:—

Nitrogen of the soluble ammoniacal salts	1·67
Nitrogen of the ammoniaco-magnesian phosphate	0·64
Nitrogen of the organic matter	11·60
	13·91

This dung from Grignon, as may be judged from the foregoing results, was infinitely richer than that which MM. Boussingault and Payen took for a standard, which contained, in the humid state, 0·41 per cent. of nitrogen, and, indeed, 10 per cent. more water than that which I analysed. But it is impossible that dung of various origin, or taken in different states of fermentation, should not present the greatest differences in their composition. I must, however, mention this important consideration, namely, that the analytical method employed by MM. Boussingault and Payen caused them to estimate the proportion of nitrogen too low. I find, indeed, in my experiments, that the nitrogen of the ammoniacal salts, in fresh dung, is 0·231 per cent.; but, after having dried the same weight of dung, it is found that the proportion falls to 0·16, that is to say, three-fifths. I show that this difference was the result of the decomposition of the ammoniacal salts by carbonate of lime. I cannot say what this loss might have been in the dung analysed by MM. Boussingault and Payen; but, finally, it had a certain value, the consequence of which is to lower the equivalent of all the other manures. I have already had occasion to say that this was the case with poudrette; it is evident that it is the same with all fermented manures. It results from all this that the table of equivalents must be modified in many parts. I should prefer to see it entirely abandoned, or rather to see it retained only as the exponent of the comparative quantity of nitrogen contained in the manures. It would thus lose a great part of the importance which it has been desired to ascribe to it; but, as a compensation, there would no longer be any risk of giving rise to any prejudicial errors. It is because nitrogen is only one of the useful elements of a manure, and the value of a manure is not determined only by the proportion of nitrogen, but it is also because the form under which the nitrogen is contained may in its turn have great influence. It does not act the same if it forms part of a putrescible organic matter, or if it is in the solid state, and, moreover, all the ammoniacal salts themselves are far from being assimilated to each other as regards the power, duration and advantage of the effects.

HORSE-FLESH.

The horse-flesh which I analysed was obtained from the horse-boiling establishment of Aubervilliers. The horses, cut in quarters, are subjected to the action of steam under a pressure of 76cc., in close vessels. The fat is separated, but at the same time the flesh undergoes a kind of washing which deprives it of the greater part of its salts.

100 parts of commercial dried flesh lost 10 per cent. by dessication at 212° F.

The proportion of nitrogen was determined by Varrentrapp and Wills' method. It amounted to 14·7 per cent. for meat dried at 212° F., and 13·23 for commercial flesh. The proportion of ash left by the latter was 5·22 per cent. This ash contained 46 per cent. of bone phosphate of lime. This large proportion is due to the bones of small animals, dogs, cats, &c., remaining mixed with the flesh after boiling.

The composition of the commercial cooked flesh of Aubervilliers is:—

Water	10·00
Animal matter	84·78
Bone phosphate	2·40
Earthy matter	2·82
	100·00

Horse-flesh is a cold manure, because it

is very poor in alkaline salts, and entirely free from ammoniacal salts. It would gain by association with ammoniacal salts or poudrette.

HORSES' BLOOD.

The horses' blood which I analysed came from the same establishment. The blood, received into tubs, is coagulated by a current of steam, and afterwards dried in the air.

It lost by dessication at 212° F., 17 per cent. of water. The nitrogen, determined in the state of ammonio-chloride of platinum, amounted to 18 per cent. in blood dried at 212° F., and 15 per cent. in commercial dried blood.

100 parts of blood dried at 212° F., left 6 parts of ash. This would be 5 for commercial blood. This ash contains all the inorganic acid salts of the blood: the quantity of phosphoric acid was found equal to 3 per cent., or 6·6 per cent. of bone phosphate.

100 parts of commercial blood contain:—

Water	17·00
Animal matter	78·00
Bone phosphate	0·33
Various salts and earthy matters	4·67
	100·00

TURF.

When the decomposition of ligneous matter takes place under water, without free access of air, the residue of the alteration retains an excess of hydrogen, and constitutes the white rotten matter of Liebig, the formula of which should be $C^{33}H^{27}O^{24}$. The turf which is formed at the bottom of marshes results, it is said, from an alteration of this kind. An analysis by M. Regnault showed it to contain an excess of hydrogen.

It is known that water is without action on turf, that the alkalis dissolve a portion of it, acquiring a brown color, and that the acids, with the exception of acetic acid, precipitate this solution, and that the precipitate has all the characters of humus extracted from mould. It is also known that turf, rendered unfertile by its state of acidity, acquires fertility by exposure to the air, or by mixture with alkaline matters, potassa and lime, or when it is used for absorbing the ammoniacal exhalations of the dung-hill. These observations tend to show a similarity between turf and humus, and seem to contradict the exceptional composition attributed to it.

I have made some experiments on turf taken at Mennecy, in the neighborhood of Corbeil: it was acid. Einoff attributes this acidity of turf to its containing acetic and phosphoric acids. Sprengel attributes the acid reaction to the turf itself. It is certain that by very long washings I have never succeeded in depriving it of the property of reddening litmus paper.

Turf, exposed to the air, scarcely acts on it. I left fresh turf in contact with the air, under a bell-glass receiver, over mercury, from the 16th of August to the 20th of October, without the volume of air having perceptibly changed, and without formation of carbonic acid.

When turf is treated with water, the water is not colored. If ammonia be substituted for water, it is colored of a light brown. In contact with the air, the liquor dissolves more and becomes deeper colored. I moistened fresh turf with ammonia, and I introduced it into a bell-glass over mercury. The absorption of oxygen took place at first with great rapidity, and afterwards slower: at the end of two months there still remained a little oxygen which was not absorbed. Moreover, we shall see that with relation to water, the air, acids and alkalis, turf acts in the same manner as mould.

Water is not colored by contact with turf, ammonia gives a slightly colored liquor; if all the soluble matters are removed by washings, and air and ammonia made to act on it again, the liquors will be again charged. If turf is treated, first with hydrochloric acid, and then with ammonia, a very dark liquor is immediately obtained, without the necessity of contact with the air, in which the acids are precipitated in abundance.

Thus turf, like mould, contains little free humus; hydrochloric acid sets at liberty the much larger proportion of humus which was combined with lime. The residue contains a matter which is rapidly changed by contact with the air and alkalis. Besides, humus extracted from turf and precipitated by alkalis, has the same properties as the humus of mould.

I have found in turf the same preserving property as in mould. I took 100 grammes of dried horseflesh, which I moistened and left to itself. All the phenomena of the most active putrefaction were developed in it. I took the same quantity of moistened flesh and mixed it with six times its weight of fresh turf; decomposition took place slowly; the animal matter was slowly destroyed, forming with the turf a compound having none of the pestilential odor of putrid meat; and which might be compared to dung in a state of fermentation.

M. Regnault found in one kind of turf

from 57 to 58 of carbon, 5·6 to 6·1 of hydrogen, 30 to 32 of oxygen. I obtained from turf from Mennecy 54·6 of carbon and 40 of water, that is to say, an excess of hydrogen. I analysed this same turf, after exhausting it with boiling alcohol and ether; it gave me :—

Carbon	53·5
Hydrogen	5·4
Nitrogen	2·4
Oxygen	38·7

There was, therefore, a slight excess of hydrogen in proportion to the oxygen.

A portion of humus, extracted from this turf by means of ammonia, was exhausted by alcohol and ether, and dried at 212° F. It gave 10 parts of ashes and 90 of organic matter. This gave by analysis :—

Carbon	54·00
Hydrogen	4·64
Nitrogen	2·40
Oxygen	38·96

By varying the preparation of the humus of turf, I have found as much difference in its composition as in that of mould.

Is this humus, then, of exactly the same nature as that of mould? I can see no difference. I am able to assert that it is equally fit for encouraging vegetation. I have sown beans in an artificial soil, deprived of organic matters, but into which I had put sulphate of lime and a little phosphate of lime. I divided it into two portions, in each of which I sowed beans. As soon as the leaves were developed, I watered them every day, one portion with humate of ammonia, the other with a solution of humate of lime produced from turf. They both grew well, but if anything, those grew best which were watered with humate of lime.

If it is true that turf contains the *white rotten matter* with an excess of hydrogen, from the manner in which it behaves with water and alkalis, it would follow that this would soon be modified and brought to the same condition as carbonaceous earth. If we consider the service which humus spread on land renders to vegetation, we must regret that turf, which is so abundant in certain localities, should not be more frequently employed as an adjunct to other manures. Suitably modified by the air and alkalis, it would incontestably render important service to agriculture.

According to some observers, the ashes of turf never contain phosphates, which is accounted for by the supposition that turf is the result of an acid putrefaction, in the midst of water, which withdraws all the phosphates in solution. Notwithstanding this, M. Berzelius has found some in turf. I have proved their presence in the turf of Mennecy, in which, it is true, they existed in very small proportion.

RESULTS OF THE FACTS AND EXPERIMENTS MENTIONED IN THIS MEMOIR.

I. Ligneous tissue decomposed by contact with humid air changes into humus, and forms at the same time carbonic acid which can be absorbed by the roots of plants.

II. The proportion of carbon in the humus of mould and of manure never exceeds 56 or 57 per cent. This is the extreme limit attained by the decomposition of ligneous tissue in contact with air and humidity.

III. Pure humus contains two and a half per cent. of nitrogen, which appears essential to its composition.

IV. Humus is but little alterable by the action of the air.

V. Humus, which is but sparingly soluble in water alone, acquires solubility by its combination with lime; but the principal agent of its solution is carbonate of ammonia, which reacts equally on free humus and on humus engaged in a calcareous combination.

VI. *Humus, rendered soluble, is absorbed by the roots of plants. It assists directly in the nourishment of vegetables.*

VII. Moreover, humus exerts a favorable action on vegetation, by attracting and retaining the humidity of the air and ammonia, by facilitating the solution of the phosphate of lime, by ameliorating the physical qualities of the soil, by moderating and regulating the decomposition of putrefiable animal matters.

VIII. Turf, modified by the contact of air, lime and alkaline substances, has all the characters and properties of mould. It is extremely favorable to vegetation, after the addition of saline matters, alkaline and earthy chlorides, sulphates and phosphates, in which it is habitually wanting.

IX. The best manure is that which contains at once earthy and alkaline salts, ammoniacal salts, putrefiable animal matter, ready-formed humus, and vegetable refuse in the course of transformation.

X. In the appreciation of a manure, we should take into consideration, not only the proportion of nitrogen furnished by analysis, but also the state in which this nitrogen exists in the manure, that is to say, in the state of ammoniacal salt or of putrefiable animal matter; in the state of soluble ammoniacal salt or of ammoniaco-magnesian phosphate.

XI. The analyses hitherto made of fermented manures have been defective, in that they have not taken into account the loss which results from the action of carbonate

of lime on the salts with ammoniacal bases, during the dessication of the manures. It results, that the tables representing the proportion of nitrogen in manures which have been published, can give only approximations.

XII. The comparative value of manures cannot be decided by merely taking account of the quantity of nitrogen which they furnish by analysis, because, on the one hand, nitrogenous matters are not the only active elements in manures, and, on the other, because the value of manures very much depends on the form under which the nitrogen exists in them; and, consequently:—

It is not possible to establish a table of equivalents for manures.

XIII. Finally, we must add to all these facts, the remarkable observation of Mulder, who has proved that humus condenses the nitrogen of the atmospheric air and transforms it into ammonia.

ON COPAL AND COPAL VARNISH. THE DIFFERENT SORTS OF COPAL FOUND IN THE MARKET, AND ON THE MODE OF PREPARING COPAL VARNISH FOR CERTAIN PURPOSES.*

BY R. SCHINDLER.

THREE sorts of copal are to be found in the market, neither of which have any other name attached, whereby to ascertain this difference, beyond the terms East and West Indian copal, the latter term including two kinds very different from each other.

As to the East India copal, also called African copal, it is softer, more colorless and more transparent than the other varieties, always having a clean surface, and emitting an agreeable odor when heated. Its form is globular, and it would be as well at once to give it the name of *globular copal*, as a distinctive mark. This is the copal which furnishes the best varnish. Old oil of turpentine has but little action on this copal; more recently distilled turpentine dissolves it completely, but not in a larger proportion than its own weight, or the excess of copal is precipitated. Rectified turpentine, or turpentine digested with sulphur, is able to take up double its weight of this copal without any precipitation;—the solution however, at this strength, is somewhat turbid.

Oil of rosemary, when thick and old, only causes the copal to swell; that which has been newly rectified, or as it is usually met with in the market, provided that it has been carefully kept, dissolves the copal in any proportion, giving a clear yellowish solution, which, in the proportion of equal parts of oil and copal, remains fluid enough for use.

This kind of copal fuses much more readily than the two others. It is less volatile, and gives out no empyreumatic oil, but only some watery acid. If the operation be performed without access of air, fire carefully regulated, and the vessels so constructed as to allow the free disengagement of the liquid substances formed, this copal is not darker after fusion than before. As soon as it ceases to froth up, the fusion is complete, and then good oil of turpentine dissolves the copal in any proportion, and forms, according to the solvent used, a beautiful and good varnish for the metals, paintings, wood exposed to the air, leather, etc., etc.

The second kind of copal, called West Indian, or American copal, is imported in pieces almost always flat, and of a size seldom exceeding three ounces in weight; it is very hard, has a rough appearance, and is without taste or odor. Its color is yellowish: it is never colorless, like the preceding. Insects are very rarely found in it. It is brought from the Antilles, Mexico, and North America.

According to Lunery it exudes, in the Antilles, from a large tree, falls into the rivulets which run along the side of the mountains, and from thence is carried away by the rivers and thrown upon their banks. According to this chemist, it owes its great hardness to its remaining a long time in the water. If we carefully examine the exterior of this copal, we shall find the outer layer, which is coarse, and not transparent, bears no impression either of sand or dirt, and rarely of leaves. Its exterior appearnce gives no indication of subterranean origin.

Absolute alcohol dissolves it in so small a proportion that no advantage is derived from a spirituous varnish, although those which are thus prepared are very hard and durable. Rectified oil of turpentine dissolves, after a long digestion, a small quantity of this copal, and, when heated for some time, the solution becomes colored; with new oil of rosemary it swells, but is not dissolved.

It fuses also with much more difficulty than the globular copal, giving off much less watery acid, but a good deal of empyreumatic oil. Fused with access of air, it becomes entirely black, unless a large vessel be employed, in which the empyreu-

* *Pharmaceutical Journal*, August, 1850.

matic oil can be readily removed. It is also blackened by repeated fusions. As soon as the copal ceases to froth up, the fusion is complete. If it has not been sufficiently fused, or if an oil of turpentine, containing too much resin, be employed, for dissolving the copal a good deal of copal settles down from the solution. Notwithstanding most minute precautions, it is difficult to prepare a varnish with this copal, free from a brown color.

The third kind of copal is imported in convex or concave pieces, weighing about half a pound each, often containing insects and vegetable substances. Its color is aromatic, its consistence is not hard, and when warm, it readily takes the impression of the nail. It is of the color of hard copal, and, in order to distinguish it from the latter, I give it the name of insect copal.

Alcohol, oil of rosemary, and oil of turpentine act on it in the same way as on hard copal. Its fusing point is between that of the globular and the hard copals. When in a state of fusion, it gives off less acid than the former, but much more oil (volatile as well as empyreumatic) than the latter; in other respects it resembles the hard copal. By careful treatment, a transparent varnish is obtained with it; but so soft, and so slow in drying, that it would be as well altogether to reject its use in the manufacture of varnish.

TO PREPARE A VARNISH FOR COATING METALS.

Digest one part of bruised copal in two parts of absolute alcohol; but as this varnish dries too quickly, it is preferable to take one part of copal, one part of oil of rosemary, and two to three parts of absolute alcohol. This gives a clear varnish as limpid as water. It should be applied hot, and, when dry, it will be found very hard and durable.

TO PREPARE A VARNISH FOR THE SCALES OF THERMOMETERS.

I recommend the following:—One part of copal, one part of oil of rosemary, and three parts of oil of turpentine, recently rectified or digested with sulphur. After a moderate digestion, the varnish is ready for use. This varnish dries quickly, but is not so hard as the preceding, although it resists the action of the air and atmospheric influences.

FOR VARNISHING LEATHER.

Especially of delicate colors, I recommend the following:—Six parts of oil of turpentine, saturated with caoutchouc, two parts of copal, and two parts of oil of rosemary. This varnish should be applied somewhat fluid, and always dried at a high temperature.

FOR VARNISHING FURNITURE.

The fused copal dissolved in oil of turpentine is the most economical. If the copal has not been kept a sufficient time in a state of fusion, the varnish made with it remains soft for some time after it is dry, and afterwards peels off.

ON THE COLORS EMPLOYED BY THE ANCIENTS—ANALYSIS AND DIRECTIONS FOR THE MANUFACTURE OF A MINERAL BLUE COLOR FOUND IN A GALLO-ROMAN VILLA,* IN THE FOREST OF BRETONNE (SEINE INFERIRURE), IN NORMANDY.*

BY M. GIRARDIN, CORRESPONDING MEMBER OF THE ACADEMY OF SCIENCES, AND PROFESSOR OF CHEMISTRY AT THE COLLEGE, ROUEN.

SEVERAL kilogrammes of this blue color were found in an earthen jar, in the state of friable concretions, but which, on close examination, had evidently been originally a fine powder. It had no taste, was insoluble in water, but effervesced violently on contact with acids; 100 parts of this blue gave 15·50 carbonate of lime, with traces of oxide of iron, when treated with hydrochloric acid. After this treatment, the insoluble powder remaining had all the appearance of ultra-marine; it resisted the most powerful heat, and was neither fused nor altered in color. The most powerful acids had no action whatever on it; it was scarcely acted upon by nitro-muriatic acid, but when heated to redness, with several times its weight of caustic potassa, it fused, and on cooling, presented a mass of a dull green color, for the most part soluble in hydrochloric acid. I could find no trace whatever of cobalt. A quantitative analysis gave me the following results:—

Silica	49·4
Alumina	6·4
Lime, with traces of magnesia and iron . . .	19·4
Soda	15·5
Oxide of copper . . .	9·3
	100·0

This blue substance is, therefore, a glass, colored by oxide of copper, in all respects analagous to the ceruleum of Vitruvius, or the Alexandrian glaze (fritte), or puzzola, which the Roman artists employed in fresco-painting, and the decoration of their apartments.

* *Patent Journal*, No. 218.

Chaptal, in 1809, made a qualitative analysis of a color of the same kind, which was found in the shop of a color-dealer, in Pompeii, and presented to him by the Empress Maria-Louisa; and Descotils subsequently recognized the same copper color in the hieroglyphical paintings on an ancient Egyptian monument.

Sir H. Davy speaks of the same mineral color, in his interesting work on the colors of the ancients, published in 1815. He states that the blue parts of the monument of Caius Cestuis, of the nuptials of Aldobrandine, and of the baths of Titus, at Rome, are done with this color. In an excavation made at Pompeii, in 1814, in the presence of Sir H. Davy, he found a pot of pale blue color, which he analyzed, and found to be a mixture of lime and Alexandrian glaze. Davy did not give any quantitative analysis of this blue color, but quoted the following passage from Vitruvius:—"The preparation of this blue color was originally invented in Alexandria, and Nestorius has since established a manufactory of it at Puzzola. It is an admirable discovery; sand and flowers of natron (carbonate of soda), are first ground together, as fine as flour, then mixed with copper-filings, moistened with a small quantity of water, and made into a kind of paste. It is then heated in an earthen pot, placed in a furnace, so that the mass becomes fused, and gives rise to a blue color." It was with this glaze, that the Roman artists obtained all their shades of blue, by mixing the finely powdered glaze with various proportions of chalk.

This same color was also found at Rome, in 1842, in the shop of a color dealer, adjoining the baths of Titus, and at Vieux, in the department of Calvados.

The beauty and solidity of this color, which resists the action of the most powerful agents, and is not affected by air, light, or moisture, ought to claim the attention of painters and decorators, especially as it is also cheaper than smalts, azure, or cobalt. It may be obtained by calcining for two hours, at a forge heat, a mixture of sixty parts of silicious sand, forty-five parts of soda, and nine to ten parts of oxide of copper.

NEW MEANS OF PREVENTING THE INCRUSTATION OF STEAM BOILERS.*

This consists in introducing saccharine matter into the boiler. A manufacturer of Lyons has substituted for sugar, the syrup of dextrine, a gummy saccharine matter, which is made in the large way from potato fecula. About six pounds of this syrup were introduced into the boiler of an 8-horse power steam engine, which was worked for a month at the rate of 14 hours a day, with an average pressure of 6 atmospheres. At the expiration of that time the boiler was emptied, and no calcareous deposit was found adhering to the inside: the metallic surface was even cleaned in a remarkable manner, especially at the upper part.

* *Industrielle Belgique.*

ON THE ALLOYS OF GOLD AND SILVER USED IN THE MANUFACTURE OF JEWELLERY, PLATE, &c., WITH AN EXPOSITION OF THE VARIOUS FRAUDS PRACTISED THEREIN.

BY WILLIAM GRIFFITHS, WORKING GOLDSMITH.

Letter VI.

To the Editors of The Chemist.

Dear Sirs,—Having, in my fifth communication (see the Chemist, No. IX., p. 406,) concluded with the last of the legitimate alloys of gold (the mixture of gold, silver and copper,) I will now proceed to show the various *substitutes* employed. A fact with which many of your readers may not be acquainted, is, that the better the quality of an alloy of gold used for the manufacture of an article, the heavier the article will be. It suggested itself to the mind of some ingenious but not over scrupulous individual that a mixture of metals with gold could be made that would present all the appearances of the richer quality with the advantage of lightness and cheapness. In a former paper, I alluded to the *protecting* power of gold over the inferior metals; and it is exhibited in a remarkable degree in the peculiar method of alloying which I am about to describe. If gold be combined, by fusion, with a small quantity of brass, the compound is brittle, and not in any way useful for manufacturing purposes; but, owing to some extraordinary chemical agency it may be rendered not only tough but exceedingly soft by observing the following proportions:—

	Troy weight. oz.	dwt.	grs.
Fine gold	1	0	0
Brass	1	0	0
Silver	0	7	8
Copper	0	2	16
	2	10	0

The advantages of employing this mixture of the metals are evident. In the first place the compound is very light; consequently an article will be only two-thirds of the weight of one made of the superior alloy. Secondly, an advantage is gained by its resemblance to 15 or even 16 carat bright gold,* its own quality not being more than 9 carat, so that by its lightness, it presents a greater surface for much less weight, and by its cheapness it may be said that one-half the cost of material is saved.

There are a great many peculiarities connected with the working of this alloy, and as they are not to be encountered in working the legitimate alloys, I will detail them as far as my own observation has led me.

The process employed for melting is this:—The silver and copper are fused in a crucible first; the gold is then added, as in the other alloys, the brass† is then painted over with a strong solution of borax, and made so hot with the blowpipe flame on a charcoal support, that the borax will become fused. This coat of flux effectually protects the brass, otherwise the zinc in its composition would sublime, and the proportions of the various metals be destroyed. When the gold, silver and copper in the crucible are well fused, the brass, prepared as above, is dropped in and the moment that it becomes fused with the mass, the whole is poured out—no time being lost, or the sublimation of the zinc would take place so rapidly that the color of the alloy would be red instead of yellow. When formed into an ingot, it may be rolled like any other alloy, with this exception:—when annealing, after its passage through the rollers, it must not be *quenched* but allowed to cool gradually; nor must it be struck while hot, otherwise it will crack and would then require remelting. In, most other respects this alloy may be treated in the same manner as the *bright* alloys mentioned in my former letters. I may mention that a great deal of the bright gold work, now sold, is made of this alloy; for instance, chains, brooches, rings, &c. The best method of testing it is by applying nitric acid to the soldered place or places of a piece of manufactured work, when the acid on the solder will turn *green*, as silver solder is used for uniting the parts of work together, which is not the case if the work is made of 15 carat bright gold. This alloy is also much used for cast solid rings, as a ring made of it looks as well as one that would cost more for the material alone than the entire cost of workmanship and material if this alloy be employed. Thus many advantages and great inducements are held out to workmen and manufacturers to substitute it for the legitimate alloys, which, to a certain extent, it counterfeits, and in the present days of competition the lowest prices generally command the greatest amount of trade, whilst the honest "jog-trot" dealer and worker is left in the rear by his less scrupulous but more enterprising rival. The want of discrimination and knowledge in the shopkeeper is a convenient medium for the deception of the public.

The next instance of deceit is still more dangerous in its results than even the former. It is no doubt well known to the greater part of your readers that nitric acid is the principal test by which the superior may be distinguished from the inferior metals—the estimate of their value (especially in the alloys of gold) being indicated by the action of nitric acid on the surface of the alloy to be tested: any alloy of gold between 14 and 8 carat will assume a certain appearance, when the acid is applied, which gives us an idea of its quality and consequent value. An alloy above 14 carat, unless a very large proportion of copper be present, will exhibit *no* change when nitric acid is applied to it; even above 9 carat alloy a *tarnish* or discoloration is the only evidence we have of its relative value; but below 8 carat, or if the article be not of gold or any alloy of gold, the surface of the object tested by a drop of nitric acid turns green, and the evolution of gas announces at once the inferiority of the metal.

It would be useless for me to detail the various signs and appearances by which the practised eye is enabled to discover the value of alloys of gold, in gradation, as the judgment is essentially of practical and not theoretical existence, but I have shown how it was *generally supposed* that the test is *infallible*; recent experience, however, proves that such is not the case, and that the chemist and the operative must find some new plan of guarding themselves and others against a fraud which it was, at one time, thought impossible to perpetrate; namely, the alloying of metals so that they should present all the appearances of gold and be capable of being apportioned, so as not only to resist the nitric acid test but to deceive the most experienced as to color and weight. Such a compound is prepared and largely used by some dishonest persons for various purposes; it can be melted, cast and wrought in the same way as an alloy of

* *See The Chemist*, No. IX.

† Very thick brass wire is generally used.

gold, and its cost varies according to the proportion of the most valuable ingredient employed. Platinum, it has been frequently observed, in works on science, when alloyed with copper and zinc, (in certain proportions) will form a substance resembling gold in appearance; but none of the formulæ hitherto published were malleable when fused, but, by the addition of a small amount of silver, the present alloy is rendered as ductile as an alloy of gold. A certain amount of platinum, varying in quantity according to the specific gravity of the alloy of gold which it is to represent, is fused * with some silver and copper previously weighed; a preparation of zinc is then intimately mixed with a flux composed of carbonate of soda and pulverised borax; and, when the metals are fused, this flux and zinc are thrown into the crucible and allowed to remain until entirely mixed; the compound may then be poured into moulds or cast into patterns according to the purpose for which the material is wanted. The cost is not more than from 7*s.* 6*d.* to 15*s* per oz., as platinum cuttings may be bought very cheaply. I said above, that this was a dangerous compound, therefore I will not give the precise proportions of the ingredients necessary. Your *scientific* readers will be able, by a few experiments, to decide for themselves, and, lest the precise compound should get into the hands of evil disposed persons, you will at once perceive the impropriety of giving more than the hints I have already dropped. My attention was first called to the above alloy, by being shewn a counterfeit sovereign which one of my own workmen had in his possession; it was by the imperfect impression that it became known to be counterfeit, although the color of the metal, the guage, the weight, and the test of nitric acid made it appear as if it were gold, yet what inducement could there be to make a counterfeit coin of gold? I resolved that I would analyse it, and the result proved that it was perfectly possible to make an imitation of a gold coin perfect even to the comparative weight and size—a difficulty which formerly could not be overcome. Platinum being heavier than gold, a little practice would enable any scientific man to determine the requisite amount of the metal necessary to imitate the specific gravity of any alloy of gold. Since the above instance, I have frequently met with articles made of alloys of platinum, particularly heavy chains, which, from their great weight, it was worth while to make of that compound, so that they might be sold for gold. The imposition was not discovered until the article required repairing, when the instant it was put into the "color pot" it became evident that it was not gold, and yet it stood the nitric acid test. What was it then? The platinum alloy! Gentlemen, by making such facts as these generally known, I hope that some test will be discovered available for the purpose of detecting this peculiar and dishonest compound, so that both the public and the tradesman may be able to protect themselves from this almost unequalled imposition and consequent loss.

I am, dear sirs, truly yours,
WILLIAM GRIFFITHS.

Dublin, August 15, 1850.

* Platinum fuses with copper and silver easily, together or separately.

ABSTRACTS OF SPECIFICATIONS OF CHEMICAL PATENTS RECENTLY ENROLLED.*

Improvements in the manufacture of Starch. THOMAS BERGER, of Hackney, Sealed January 26, 1850.

"I would at the outset state, that although I shall hereafter describe the action of caustic alkali upon rice, I do not claim the same, inasmuch as Mr. Wickham of Nottingham, took out a patent for this object in the year 1824. In carrying out my invention, I find it advantageous to steep the rice in the first instance, in succession, in three or four separate solutions of the caustic alkali (soda preferred) of the following strength; viz., from 190 to 220 grains of pure soda to every gallon of water. I then proceed as follows:—A ton of rice having been thoroughly steeped in three or four separate solutions (of about 300 gallons each) of the caustic alkali, and drawn off, it is now to be ground as fine as possible by means of levigators, with cold water to the consistence of thick cream or paste; to this is to be added one pint of spirit or oil of turpentine, with sufficient cold water to make up the bulk 2,000 gallons; the whole is to be stirred for three hours, after which it is to be passed through a series of coarse flannels, felt or sponge, until the whole of the refuse is deposited upon the flannel or filtering medium; or it may be left to repose for about half an hour, when the starch suspended in the water may be drawn off from the refuse matters.

"These starchy waters are always to be passed through fine lawn sieves, prior to

*Collected from *The Mechanics' Magazine.*

their being allowed to deposit the starch in the settling vessels. The application of water may be repeated, if it be thought desirable, to separate further quantities of starch from the refuse. As soon as the starch is perfectly deposited in the settling vessels it is to be collected, and, if alkaline, neutralised with dilute sulphuric acid, adding eight ounces of sulphate of zinc to every 112 of starch: it is now, after well stirring, to be boxed and finished in the usual way.

"The above is the process I prefer and have found most efficacious, simple, and least expensive, but the metallic salts in general, also sulphate of soda, (especially if combined with lime-water), turpentine, alum, and a current of electricity, will severally be found effectual in the place of the turpentine and sulphate of zinc. I do not therefore confine myself to the process described, nor to the quantity of either of the agents employed, nor to any particular combination of them.

"When currents of electricity, (however produced), are employed, the application should be continued for about two hours on each occasion, and the same is to be passed through fluid starch; as electric currents are commonly passed through fluids, and I stir the fluid starch all the time of applying such currents.

"I use a Smee's battery, of six cells, about 5 inches by 7 inches, when acting, to produce 5 cwt. of starch, and I have found it desirable to apply the electricity first to the rice when ground with water, and lastly to the starch previous to its being boxed.

"Another part of my invention consists of the application of a barrel or vessel containing the rice and the alkali solution, and caused to revolve by any convenient means at the rate of about one revolution per minute, which I have found to be very efficacious in extracting the gluten from the rice; the size of the barrel I prefer is about 5 feet in diameter, and about 5 feet in length, which will contain a ton of rice; and the 300 gallons of alkali solution I have found, allowing each solution to remain upon the rice three hours while the barrel is at work to be amply sufficient.

"I do not confine myself to the use of a barrel, as a vessel of other form will answer the purpose; or, in place of causing the vessel to revolve a stirrer caused to revolve whilst the vessel stands still, will produce a like effect; but I prefer the vessel to revolve.

"My claims are as follows:—

"1. The manufacturing starch from rice by using turpentine and sulphate of zinc as described, and also the straining the starchy waters, and boxing the starch in those stages.

"2. The use of metallic salts, also sulphate of soda, turpentine, alum and electricity, whether separately or in combination in the manufacture of starch.

"3. The use of flannel, felt, and sponge, as a medium for separating the refuse matters from starch.

"4. The application of mechanical stirring, or the rotation of the vessel containing rice when being steeped in a solution of caustic alkali, or other solutions used when making starch from rice."

Improvements in the manufacture of Epsom and other magnesian salts; also alum and sulphate of ammonia. THOS. RICHARDSON, Newcastle-upon-Tyne, Chemist. Sealed January 26, 1850.

1. Mr. Richardson takes rough Epsom or an impure solution of sulphate of magnesia, and mixes with it a precipitating agent—by preference magnesia. The mixture is well agitated and heated; it is then allowed to stand, in order that the impurities may be precipitated, and decanted off. The pure solution is next evaporated, until it is concentrated to from 50° to 60° Twaddell's hydrometer, and is subsequently placed on one side to crystallise. Strontia, baryta, or lime may be used instead of magnesia as a precipitating agent, but not with with the same advantage, as it would combine with the ammonia in the solution. When either of the sulphurets before enumerated is to be employed as the precipitating agent, it must be used in solution. Instead of using the substances (rough Epsom and magnesia) in solution, they may be ground up together in a moist state, and the Epsom subsequently dissolved out. Carbonate of magnesia is obtained by calcining the magnesia employed in the purifying process. To produce a double salt of magnesia and ammonia, gas water is mixed with a pure or impure solution of sulphate of magnesia, and boiled until rendered neutral. The mixture is allowed to crystallise, and the salt is to be used as manure. Or sulphate of magnesia, in a damp state, may be subjected to a current of ammoniacal gas, produced by the distillation of gas water, guano, or other ammonia-giving substance. If required, the gas water is to be neutralised by the addition of sulphuric acid.

2. The improvements in the manufacture of alum consist in the employment of (say) eight pits, the first and last of which communicate with one another, and with the intermediate ones, which also commu-

nicate with each other by means of a vertical pipe that rises inside one of them, and is fitted by means of a tap at top, while its lower end is curved, and opens into the lower part of the next pit, and so on throughout the series. Above the mouths of the pits there is a horizontal pipe, communicating with the water reservoir, which is provided with a number of cocks, one for each pit. When the pits are charged with shale, &c., water is admitted into the last, where it remains for some time till the substance is exhausted. Fresh water is admitted, and the liquor then flows into the first, where it remains some time to effect a like purpose. Afterwards fresh water is admitted, to cause the liquor to flow into the second pit in the series, and so on until it has reached the required degree of strength; it is then drawn off by a cock at the bottom. When the contents of the pit are exhausted, they are successively replaced by a fresh supply.

3. The patentee proposes to manufacture sulphate of ammonia by employing the double salts produced according to the method described under the first head of the specification, and subliming it in the usual way.

CLAIMS.1. The employment of magnesia, strontia, baryta or lime, or of the sulpurets of strontium, barium, sodium, magnesium, ammonium or calcium, in the manufacture of Epsom or other magnesian salts.

2. The improvements in manufacturing alum.

3. The mode of manufacturing sulphate of ammonia.

Improvements in the Manufacture of Steel. (A Communication.) EDWARD RIEPE, Finsbury Square, Middlesex, Merchant. Sealed January 29, 1850.

1. Mr. Riepe places 280 lbs. of pig-iron in a puddling furnace, and heats it till it melts; then throws in from 12 to 16 shovelfuls of cinder slack, and partially closes the damper. When the iron begins to trickle down, 40 lbs. of pig-iron are placed on cinder beds near the bridge, and the damper closed. When this last melts and begins to trickle down, it is raked into the melted metal below. The damper is then three parts opened, and the heat continued until it boils, and the well known blue flames shoot through the cinderslack. The heat is maintained at a cherry red, the damper open, and the mass puddled to and fro through the cinder slack. When the mass begins to granulate, and the grains to fuse, the damper is closed, and the operation watched; when the boiling ceases, the mass assumes a waxy appearance. The fires are then stirred to keep up the temperature, and a portion taken out in a ball, and tilted or otherwise hammered into shape. In the case of pig-iron made from scrapy-ore, he adds only 20 lbs. of pig-iron, instead of 40 lbs., at the latter part of the process; and when using refined Welsh iron, he strews the floor of the furnace with 10 lbs. of best dry granulated clay, and covers the metal with a like quantity of clay.

2. The patentee casts pig-iron, or alloys of pig-iron and wrought iron, into bars, with notches to facilitate their breaking. They are then covered with clay, and arranged with spaces between. The furnace underneath is lighted, and all the apertures closed except the flue and a small one which is temporarily closed, but may be opened when required, to allow of a sample being withdrawn to ascertain how the operation proceeds. When the conversion of the iron bars is effected, they are removed, and the clinkers, &c., knocked off.

3. Or the iron may be placed in a fireproof cylinder of stone or earthenware, which is heated by a furnace, placed underneath, and has its two ends closed, with a pipe attached to each. The fire is lighted, and the iron heated to redness. The pipes are then opened, and the air will pass through, and, from the manner in which the bars are arranged, will come in contact with all their sides. When the annealing is completed, the iron is cooled down and removed.

CLAIMS.—1. [As regards the conversion of pig-iron into steel.] Regulating the heat in the finishing; the exclusion of atmospheric air from the mass; the use or addition of pig-iron at the latter part of the process.

2. Converting pig-iron, or alloys of pig-iron, and wrought iron into steel, by exposing them to the action of clay at a proper temperature.

3. The peculiar method of annealing bars of pig-iron, or alloys of pig-iron and wrought iron, by exposing them to atmospheric air when at red heat.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

SANITARY NOTES.

NO. IX.

(Continued from Page 521.)

THE REPORT proceeds to describe the portion of country, which, after much research, over an area extending about 30 miles round London, has been fixed on as the "gathering ground" from which the metropolitan water supply should be derived.

Directions had been given for a close examination of the extensive district, commencing with the Bagshot and Woking sands, &c., extending to Hampshire where Prof. Way called attention to a specimen of water which he had found at the extremity of the district, at the town of Farnham which was supplied by the drainage of less than two acres of the common land. The specimens of water so derived, which he analysed were only of half a degree of hardness and were in other respects of extraordinary purity. At times the water is apt to acquire color from an infusion of peat; but the thorough drainage divests it of all peaty color, and it is delivered clear and limpid at all periods of the year.—p. 96.

A geological description is given of the Bagshot sands, extending from Esher to Strathfieldsaye, and from Virginia Water to Farnham, an area of 300 square miles. The composition of the beds of this series is remarkably uniform, consisting of 1st. The Upper Bagshot, from 200 to 300 feet in thickness; generally a fine light brown sand. It appears to be nearly pure silicious sand, slightly colored with an oxide of iron. 2nd. The Middle Bagshot, from 5 to 20 feet thick, composed of a green sandy bed on white and pale yellow foliated marls. 3rd. The Lower Bagshot, mostly silicious.

The rain that falls on the Upper Bagshot sands is necessarily absorbed; but it is checked in its downward progress by the 2nd Bagshot, or Bagshot marls, and on the outcrop of these marls are series of springs which are to be collected and stored.

The portion of this district to which our attention has been more immediately directed, comprises an area of less than 100 square miles, lying east and west of a line from Bagshot to Farnham. The remaining district which we have had under consideration, although of the same bleak and barren character is of different geological construction, consisting of the upper and lower green sands and gault of the green sand formation, and constitutes the uncultivated sand districts draining into the east and west tributaries of the river Wey, situated south of the chalk ridge in the midst of which the town of Guildford stands—.p. 100.

With respect to the nature of the water, specimens of Farnham water gave the following analysis:—

Hardness about 2½°.

	Grains in a Gallon.
Silica	·55
Lime (as silicate)	·375
Sulphate of Lime	·280
Sulphate of Magnesia	·557
Chloride of Magnesium	·552
Chloride of Sodium	1·440
Chloride of Potassium	·354
Organic matter and water of combination	1·245
	5·323—p. 103

The Frensham water had 5·45° of hardness, and contained 6·9 grains of dissolved matter, viz.:—

	grs.
Of Sulphate of lime	2·29
Carbonate of lime	2·343
Chloride of calcium	·995
Chloride of sodium	·66
Chloride of potassium	·118

with a little magnesia and carbonate of soda, and also silica.—p. 106.

The greater part of the water is more or less colored with peat. Dr. A. Smith said, this is not considered objectionable, as peat is highly antiseptic, is not considered favorable to the production of animalcules, and is not directly convertible into animal life, like the organic matter in the Thames and most river water. The only objections to it are the taste and color. p. 105.

Dr. Playfair said, this is the least noxious organic ingredient in water, because by the action of oxygen it speedily becomes insoluble. When colored peat water comes in contact with other water not containing peat, as it would do by being mixed in a reservoir, the peaty impurity soon is rendered insoluble by the air dissolved in the latter—p. 108.

With respect to the quantity, it is considered that the tract of 150 square miles will afford sufficient supply. The water from 70 to 80 miles of these grounds is stated to promise a supply of 28,000,000 gallons per day.—p. 108. But at p. 103, it appears that this quantity was the result of guagings after a *six weeks' rain fall*. In this place, a most important part of the question, it must be pointed out that an average rainfall of 24 inches in the proposed district gives but 140 million gallons per day, and if from 15 to 20 inches of this be lost, as is said to be the case, (say 15 inches) there will remain but 47 million gallons per day as the average supply; and in fact the above guagings over half the district give but 28 millions after a rain fall of six weeks. Now, in 1840, the rain fall was 16½ inches only, and in 1847 was 17½ inches; here would be a sad deficiency at a time when the loss from evaporation, &c., would certainly be above the usual average. But to proceed. It is stated, in conclusion, that the nature of the source of water supply requires extensive storage-room, the excavations for which must be large and extensive, as the country presents no deep natural hollows. [This, be it remembered, in a deep sand.] It is also recommended that the practice of the Roman engineers should be preferred to that of modern engineers, and that the service reservoirs and aqueducts should be covered to the utmost extent practicable.—p. 113.

Judging by the derivation of the small water supply for Farnham by underdrainage, it might be found to be worth while to use the same method very extensively for increasing the quantity, as well as for improving the quality of the discharge. It is doubtful, however, whether at some parts where the sand is very deep and the present surface indurated, more would not be lost than gained, by breaking through the present surface to underdrain it. That doubt can only be settled by more close examinations and trials of the soil. It is reported by Mr. Donaldson that the peat on the surface of the sand is generally so thin, that it may be very cheaply removed, and may, in great part, pay for the cost of removal. This is an operation which may be cheaper than any subsequent one for removing from the water any infusion from the peat. There is reason to believe that other improvements of the surface of this area may be effected at a cheap rate, so as to adapt it more completely for the reception and quick discharge of rain water.—p. 114.

The land is to be taken for the public under an Enclosure Act, and re-let with restrictions as to water rights and cultivation, the manorial and common rights being compensated for.—p. 115.

The engineers of the board estimate the total expense of storing and bringing to the metropolis this new and improved supply, inclusive of reasonable compensation for waste land for the reservoirs, at little more than one million sterling. The board fully believes that two years' saving from the use of the purer water would fully repay this portion of the outlay. Various detailed estimates have also been made of the expense of the distributory apparatus into houses of all classes. The result is, that an entirely new supply of the softest water

may be brought to the Metropolis, pure, filtered, and well aërated, and may be delivered into every house in the metropolis for all purposes, at an average original rent-charge inclusive of the expense of the tenant's supply pipe and tap, of 2d. per week per tenement.—p. 116. This closes the first and main portion of the report.

II. As to the present mode of distribution and its influence on the quantity of water required for the metropolis. According to returns made by the seven companies, the average quantity delivered daily to each house or building and vouched for by the officers of the companies as actually consumed, varied from 132 to 255 gallons, the average of the whole being 173 gallons. This quantity appeared to the board to be an "impossible" average consumption, and led to enquiries which brought out important results. Very careful guagings were made of the run of water in the sewers of a particular district, and guagings were also made of the consumption from the butts and cisterns during the intervals of the delivery of the supplies by the company. It resulted, that the waste in this district from defects in the house apparatus of distribution, incident to an intermittent system of supply, was, on the water days, 3¼ times greater than the consumption in those days. The waste during the whole week was not less than ⅔ of the actual quantity consumed. Thus the waste in that one district (of 1200 houses) was at the rate of upwards of 4½ millions of cubic feet, or above 28 million gallons per annum.—p. 121.

There are about 900 gallons delivered into the five water-butts which supply six houses in Whitechapel, draining through a 9-inch pipe sewer. The water-butts hold together 210 gallons, and all the rest runs to waste; 540 gallons of this is found by guaging to pass through the drain. In another instance, near the Edgeware Road, the cisterns of six houses contained, before the water is newly turned on, 696 gallons, and after the water is turned off and they are full, 1,086 gallons; the quantity, therefore, *used* and passing through the sewer in one or two days of interval is 396 gallons; but on the water day 1,188 gallons passed through the sewer, so that 396 gallons were used, and 1,005 gallons wasted in two days. In Park Place, St. James's, during the hour of supply there pass through the 12 inch sewer pipe from nine houses, 4,320 gallons, while the quantity actually used per day, and passing through the sewer when the water is not laid on, is 3,660 gallons, the quantity wasted being about as much as that used.—p. 124.

From the various examinations of the quantity of water actually consumed, it results that out of a daily supply to the metropolis of nearly 45 millions of gallons, 30 millions are daily pumped in waste. As applied to the excessive water supply, the term "waste" has been used; but if this large volume of water could only be considered as so much wasted, it would represent a certain amount of loss in money alone, borne by the public, it is true, and consequently a grievance, requiring at the hands of the legislature a corrective remedy. But the actual results are far worse; this water is not only waste, but a positive injury to the landlord as well as to the tenant; to the landlord by creating undue damp, and thereby injuring his property; to the tenant, by saturating the whole subsoil with fluid refuse, tending to generate foul and highly dangerous gases; as also by rendering the basement floor, the walls and yards unduly damp, producing all those ill effects known to exist in connexion with swampy undrained districts.—p. 127.

Much evidence and illustration is given, both as to the saturation of the ground by the water, and the sanitary evils of this flooding; the prevalence of epidemic disease being found to bear a proportion to the state of drainage and of the excess of damp, where other conditions are similar. Returns were obtained by house to house enquiries, from three parishes, displaying

the position of the water supply in relation to the cesspools and other sources of impurity, and as far as possible of the numbers of persons who had been ill; these show a frightfully insanitary state of things, and make out an irresistible case in proof of the assertion that works to carry away waste pipe water, must, in a town, form part of, and be arranged and maintained in harmony with the works to bring in water, and that they should be executed and maintained under one and the same administrative direction.—p. 136.

The case of New York is referred to, to prove the absolute necessity of combined works of drainage and water supply. Before the introduction of the Croton water, wells were used, which had the effect of draining the ground. Now, not only is this not the case, but larger quantities of water are used for cleansing the houses and streets, and consequently as the city is very imperfectly drained, the evil of damp in the basements and cellars is extensively felt.—p. 137. Besides, the great importance of the distributory apparatus in respect to salubrity, in point of expense the change to a system adapted for a constant supply would effect a great saving.—p. 138 & 139.

Evidence was taken as to the advantage of the constant supply system, both as to saving in the quantity consumed, and as to the amount of outlay both in pipes and distributing apparatus in some of those towns where it is in practice, as in Preston, Ashton-under-Lyne, Wolverhampton, and indeed in one little district in Bermondsey. —pp. 140–148.

Tables are given of the charges made by the companies for high service, showing that in some cases they amount to 18 times the actual cost to the company for pumping.—p. 154.

It appears to the Board that there are three reasons of importance to the public against a retention of the intermittent system of supply:—

First, that neither private traders nor private consumers, if they may be so designated, can have any just claim to carry on a method of supply, one consequence of which is a waste of water greater than the supply itself, which causes a flooding of houses, by which others besides themselves are subjected to the injurious effects of damp and to charges for the removal of the excess of waste water.

Secondly, The excess of waste water consequent on an intermittent supply must obstruct the public arrangements necessary for the removal and application of sewer water as manure, and for preventing the pollution of the river.

Thirdly, The retention by water companies of the intermittent system of supply for the higher and middle class of houses, enhances the expense to the public, and the danger to life and property, keeps up excessive insurance risks, and is mainly chargeable with the destruction arising from the present imperfection of the arrangements for extinguishing fires.—p. 158.

From all the information received in respect to the present habits of the population, and the probable extension of the use of water by the introduction of supplies of superior quality and improved distribution, it will be an ample estimate, comprehending, indeed, many new and unforeseen uses, if provision is made for the daily supply to the whole population of an average equal to the actually ascertained consumption in houses of the higher class, namely, of about 75 gallons per day per house. This would amount, for the 288,000 houses within the Registrar General's metropolitan district to 21½ or say 22 millions of gallons per day. Add to this for large consumers, for fires, street watering and flushing, and there will be a total of 26 millions of gallons per day, making for 288,000 houses little more than one-half the average quantity now delivered for the supply of 270,000 houses only.—p. 163.

An attack is then made on engineers and chemists for interested, ignorant, and (upon the case stated) dishonest opinions and advices.

III. As to the mode of removing water after it has been used and discharged, especially in the case of the damp and low lying districts of the metropolis.

This section is occupied with a detail of the controversy respecting large and small sewers, brick house drains, and earthenware pipe drains. An attack is made on the Report on the city sewers by Messrs. Walker, Brunel, and Cubitt, and extensive details are given of the experiments made in different localities upon the discharge of sewers of various sizes. The Report states that it should be borne in mind that the evil of extended cesspools, house drains, and sewers, constituting for London an evaporating surface, represented by a canal 30 feet wide and 40 miles long, giving off noxious exhalations amidst streets and houses (varying in copiousness with barometrical conditions, and being most copious when the barometer is low, and the population most depressed) mainly arises from the non adjustment of the drains, main and branch, and the waste pipes to the ruh of the waste or polluted water; and from the neglect to economise power or diminish friction by attention to the forms as well as the inclinations of that apparatus.—p. 181.

It does not belong to this Journal to enter into the details of this, which is a purely engineering subject. It will suffice to intimate the results.

The practice of flushing is utterly condemned. The arrangement which the Inspectors have agreed on, as effectual for the prevention of deposit, is to carry up a proper inclination of the main sewers from the lowest levels, so as to keep up a uniform rate of flow, and to discharge the contents by pumping at the outfall, and thence convey it either in the direction of any demand there may be for it as manure, or, until the land is fitted for its reception, to discharge it low down the river, at a distance whence it could not be brought back amongst habitations by the return tide.—p. 220.

The proportion of soluble and insoluble matter in sewer water is usually less than one to two hundred and fifty times its volume; night soil is pumped with two or three times its volume of water. So there can be no difficulty about the pumping.—p. 224.

Attention is paid to the complaints of noxious gases rising through gully holes, and reference having been made to the various plans for correcting the evil, it is stated that on a review of the whole evidence, it appears that there is no true remedy for the evils in question but that which prevents the accumulation of refuse matter, by providing for its immediate and rapid removal.—p. 228.

IV. On the advantage of a system of constant supply for surface cleansing, diminution of risk from fire, and new applications of water, as a source of power.

The advantages for the first of these three purposes are eminently sanitary. Details are given of the cleansing of several horrible courts and the results. It may be stated generally that the effect of this mode of cleansing in close courts and streets (i.e. by the hose fixed to water-mains) was found to be peculiarly grateful in hot weather. The water was first thrown up and diffused in a thin sheet, it was then applied rapidly to cleansing the surface and side walls as well as the pavements. Mr. Lovick states that the immediate effect of this operation was to lower the temperature and to produce a sense of freshness similar to that experienced after a heavy thunder shower in hot weather.—p. 223.

Judging by the trial works, the carriage-way and foot-path of the Strand may be completely washed in six days of the week in one hour, before the commencement of the traffic, at a charge of little more than 4d. per house per week, and with a more powerful jet, it might be done for less than half that sum. It is estimated that for a penny per house the thoroughfares in one quarter of the streets might be washed once a day, and in one half of the streets twice a week.—p. 237.

As there are sanitary evils resulting from the evaporation of water containing animal and vegetable matter in a state of decomposition, it is not advisable that Thames water, such as the Lambeth Company supply, should be used even for this purpose.—p. 224.

For the cleansing by the jet, a body of mechanics and labourers would be required, who could be employed in subsequent parts of the day in other labors requisite for the complete removal of refuse. They should be directed by a competent mechanic, who might, also, in place of the turncock, have charge of the keys of the water plugs and hose.—p. 245.

With respect to the second subject under this division, viz., security from fire, the Board, have anxiously investigated the subject, and give details of the loss of time in fetching the present fire engines, and the consequent increase of danger and loss of property. But under a constant supply at high pressure, by night as well as by day, it might be ensured that a hose should be within reach, fixed on the street plugs, and applied, on an average, of not more than five minutes from the time of the alarm being given, i.e. in less than one-fourth of the time within which fire engines are brought to bear under the existing arrangements.—p. 251. It is proposed, however, to retain the services of such a trained force as the fire brigade, and put it on a more efficient footing.

As to the third subject, viz., new applications of water as a motive power, the idea appears to have originated from witnessing Armstrong's hydraulic cranes, and the Board points out that with a constant high pressure supply, a tap merely is turned, and the hydraulic pressure becomes a means of motive power, as in the Bramah press, or any engine on a similar principle, while the power is applied at once, and may be immediately discontinued.—p. 262. The adoption of this plan would save a heavy expense in many warehouses, and tend to check the multiplication of small steam engine furnaces and the apparition of the smoke nuisance.—p. 265.

V. Conclusions—On the advantage of combined works of water supply and drainage, and the administrative machinery necessary for their proper execution.

It is estimated that the following quantities of water would meet the present necessities of the metropolis :—

	Gallons.
An improved domestic supply of 75 gallons per day to 288,000 houses.....	21·600·000
Supply for new baths	1·000·000
Supply for general surface, cleansing of courts, foot pavements, carriageways of paved streets, and street watering.	10·000·000
New demands for brewers and other large consumers.....	4·000·000
Fires and contingencies.....	3·400·000
Total daily supply	40·000·000

To supply this demand, and any probable extension, we have the following estimated quantities of water available from the proposed new gathering grounds, as calculated from the extent of area, and guagings taken at the end of nearly six weeks *dry weather*.

	Gallons per day.
From what may be called the Farnham water district, having the whole an average hardness of under 3 degrees.	28·000·000
From certain tributaries of the Wey—average hardness ½d that of the present supply..	60·000·000
From other tributaries of the Wey—average hardness ½ that of the present supply..	90·000·000

—pp. 265, 266.

At page 103, it is stated that the produce of 28 millions, from the guagings of the Farnham district, was after a six weeks' *rainfall*. Indeed, in no part of the Report are there any statements to warrant confidence in the *sufficiency* of the supply from the proposed district—at least without including the chalky waters of the Wey.

The engineering inspectors believe that storage room for 60 days' full supply would be an adequate provision.—p. 267. It is known, however, that occasionally in this district there have been 90 days without any rain.

It is proposed to retain the Grand Junction and Vauxhall water works at Battersea,

as having superior filtering reservoirs.—p. 267.

The recent expensive schemes for introducing more water are disposed of and condemned, and a summary is given of conclusions to be derived from different parts of the Report. It is not necessary to repeat them.

As the sources of the present supply are generally rivers or common streams, the Companies have no property in the water itself, their capital consists in their machinery and distributory apparatus; and this should be fairly and liberally paid to them.—p. 272. But the Board have not been able to fix on any preappointed principles or terms of purchase, inasmuch as each set of works appears to have its own distinct value and each company its own special case.—p. 274.

The Board feels compelled to recommend, as the only means of effecting the requisite combination of works, an extension to the Metropolis of the Public Health Act, with those additional provisions as to the special nature of the administrative machinery and means of public responsibility which the extraordinary nature of the case may require.—p. 275.

Both the above and under ground surveys are so far completed that combined works may be proceeded with at once, and especially in the low lying districts.

The plan recommended for discharge of the sewage is to convey it in pipes to Erith, selling some of it by the way if possible, and then discharge it into the river beyond reach of return.—p. 280. Happy London! Unhappy Gravesend!

The estimates are,

For necessary Water works....	£1,432,000
" " Sewage works...	710,000
	£2,142,000

The latter portion of the Report is taken up with a defence of centralised authority in lieu of local and divided authority; a reiteration of much of the economical matter, previously dilated on, and finally concludes with 63 clauses embodying the whole results of the Enquiry.

SKETCHES OF PHARMACEUTICAL SAVANS.

BY CORNELIUS CORKSCREW.

No. III.

MR. THOMAS N. R. MORSON.

A LAMENTABLE position indeed it is for a man fast verging into the sear and yellow leaf, to find himself after a career spent with credit in mercantile pursuits, an object of suspicion and bitter feeling amongst his professional brethren from his unenviable conduct in connexion with the Pharmaceutical Society. Had Mr. Morson devoted his time and his energies to the promotion of the objects of this Society, without giving such unmistakeable evidence of being imbued with that disreputable failing, nepotism, he might have maintained his reputation unsullied, and acquired the respect and gratitude of all its members.

Mr. Morson has by praiseworthy industry, united with great shrewdness, raised himself from a humble position to the proprietorship of one of the most lucrative businesses in the metropolis, that of a manufacturer of Pharmaceutical chemicals.

In consequence of this occupation, he is supposed by the uninitiated to be a scientific chemist; but this notion is altogether a delusion, for the skill required to follow a process devised by another person is vastly inferior to the skill which invented the process. In short, a man who is merely a manufacturer of chemicals cannot be said to be a scientific man at all, for his art consists merely in following well defined formulæ. He stands in the same relation to the chemical philosopher, as a stoker does to a Hall or a Stephenson. Of course it does not necessarily ensue, that a chemical manufacturer is not a man of science, for there are many examples on record to the contrary.

In testing any one's chemical scientific capabilities, we ask ourselves these questions. Has he contributed to the advancement of the science of chemistry? Does he exhibit an intimate acquaintance with one or more of its departments? Is he an analyst who may be relied on? When the answers are all in the negative, as in Mr Morson's instance, we deny to that person the right of being considered scientifically endowed. We have been at some trouble to render this matter clear to remove the delusion above spoken of, which exists in reference to several persons who, to elevate their self-importance, lose no opportunity of propagating this absurdity.

Mr. Morson may be considered a man of the world, a person who has his wits about

him. Such people generally succeed in obtaining a good share of the sweets of this life. Knowledge or skill they only regard or care to acquire so far as it can be turned into an £ s. d. profit. This is the sum and substance of their elaborate researches.

To induce Dr. Turnscrew to remark in his forthcoming treatise on Neuralgia, that atropine, *as prepared* by Mr. Snooks, has been attended with the happiest effects in all the cases recited, is the greatest desideratum to them in this world, because it is the shortest road to Californian greatness. Like Abernethy, they prefer a drink of small beer to posthumous fame.

Such people write a man down an ass who pursues science for its own sake, a creature to be avoided as chimerical, and more likely to draw the one thing needful from the pocket than to cause it to multiply therein, and therefore totally unworthy of their recognition or sympathy.

After having given, as we believe, a correct estimate of these soulless plausible Pecksniffs, it cannot be a matter of surprise that they carry their predilections into whatever position their sagacity may provide for them.

Thus it is in the Pharmaceutical Society, a society established under the pretence of conferring an enduring benefit on the great body of oppressed and ill-requited druggists of this country. Ask any member except the sagacious Pecksniffs, what protection or advantage the Society has been to him, and he will be sorely puzzled to reply. All that he is really conscious of is, that he has paid a certain sum annually, and received Bell's journal monthly. He thinks, nevertheless, there must be something more enticing at head quarters, that is, in the council, or else such men as Mr. Morson, who have always an eye to the *quid pro quo*, would not stick so pertinaciously to their posts: and there is something worth laboring for at head quarters. There is the opportunity of making oneself known—an unrivalled specimen of Gallic acid, labelled Morson, can be exhibited to admiring doctors. Some fine crystals of morphia, warranted free from salicine or sugar, will attract attention. Who knows but that one may ultimately supply the Society with chemicals, or even soap and candles. Besides, there are well paid officers in the Society. There are those of Curator of the Museum, Librarian, Director of the Laboratory, Professor of Chemistry, and Professor of Pharmacy. If unqualified or unable to obtain these appointments oneself, a relation in whom one feels particular interest may be thrust in. It matters not whether he is incompetent to fulfil the duties either from mental incapacity or want of physical ubiquity, nevertheless he must enjoy the emolument arising therefrom. If the Professor of Chemistry dies, his office may be consolidated with that of Professor of Pharmacy upon the plea of economy to the Society. The members will swallow all this plausible logic, for they have such faith in their disinterestedness and their judgment.

This we consider to be a correct portrait of the mental operations and calculations of such men as Mr. Morson, under whose auspicious patronage is it to be wondered at that the Society fails to perform its original promises, and does not prosper whilst Mr. Morson's star is in every direction in the ascendant. These men, when they make a trifling sacrifice for others, do so that a greater gain may arise to themselves.

Time and the increasing cupidity of these Pharmaceutical Pecksniffs will at length unmask them. It will show their rapacity in all its nakedness. It will exhibit the real value of their loud and fawning protestations of gratuitous zeal and devotion. The Society may perish when they or their kindred can no longer absorb all its advantages. It was to them a mercantile speculation, a safe investment for their money, in which a small sum discreetly laid out would realize hundreds annually by the notoriety and confidence it would create in the medical mind. In this respect their wishes and hopes have been gratified. Their success is the highest compliment that could be paid to their foresight. An unmolested career of nine years has been a succession of such rich harvests, that if they were now gracefully to retire, they would find a sufficient consolation in the fact that they had already reaped more than the most sanguine calculators could have been justified in expecting.

As the Pharmaceutical Society now exists, it may be said to be impersonified in Messrs. Morson and Bell, in fact they are the Pharmaceutical Society. They nominate the Council. They appoint the Examiners, Professors, Auditors, and themselves. They arrange the various committees of the Council. If a man is likely to be troublesome on the finance committee, such as requiring a disagreeable amount of explanation as to the disbursements, he is instantly removed to one more suitable to his *talents*. If such removal does not prevent him from becoming meddlesome, he is quietly blackballed at the next election if he has not the penetration to anticipate this feat of legerdemain by resigning. Mr. Morson never votes against anybody, and is always ex-

tremely surprised and disappointed that the candidate has not been elected, for he made sure he would be. *Credat qui vult.*

Talleyrand has said that speech was given to man to hide his thoughts, and perhaps unwittingly, Mr. Morson is a strict disciple in miniature of this great diplomatic hypocrite.

Unlike Mr. Jacob Bell, who courts the opinions of his opponents rather than avoids them, this man quails with all his assurance in the presence of those whose powers of observation will detect disingenuousness and cupidity however cloaked. Every member of the Pharmaceutical Society shall consider it a duty he owes to himself and his brethren, to oust this man from the Society, in spite of his *suaviter in modo*, as the natural enemy of pharmaceutical progress, and as one whose interests and feelings are adverse to every other member's. Until the members have the courage to perform this duty, they will have no act of Parliament to protect them in their legitimate occupation, or to give durability to the Society. Mr. Morson's schemes are incompatible with any legislative enactment, for Parliament will never grant power to a Society at once to educate and to examine for the purposes of testing the efficacy of that education. He knows that the constitution of the Society is inimical to the attainment of that for which it was avowedly established viz. protection to the duly qualified chemist—yet with organised hypocrisy he and his clique are always preaching about their great, but at present unsuccessful, endeavors to secure this important object. An act of parliament must necessarily abolish the school in which he feels such a very particular interest, for reasons that are obvious to all. We positively assert, that so far from using any exertion to secure legislative protection, Mr. Morson secretly hates the very mention of this subject, and is prepared to make even sacrifices to thwart the members in accomplishing their purpose.

Moreover we speak advisedly, when we assert that there is no great difficulty in carrying through Parliament a measure to secure this desirable boon to chemists. No branch of the profession is opposed to it, and the public are alive to its necessity. The obstacle alone exists in the Society: it is the treachery on the part of those who are determined to maintain the School and the Journal intact at any cost.

In proof of the treachery of those men who pretend to be labouring assiduously for an Act of Parliament for the Pharmaceutical Society, and are constantly asserting that the proper time has not arrived for making an application to the legislature, when their real object is to promote alone the Pharmaceutical school and other abuses, we quote a speech of Mr. Morson's, delivered at the Society, in May, 1846.—"It might indeed perhaps be asked, why was it not proposed that the powers to be given to this College, (i.e. a proposed College of Pharmacy), should be conferred on the Pharmaceutical Society? This question had engaged the serious attention of the Council, and they had come to the conclusion that it would be impracticable to obtain Act of Parliament that would confer upon the Pharmaceutical Society the powers of examination and of granting certificates to practice Pharmacy while they continued as they are now, an educating body. *All the authorities, both legal and parliamentary had agreed upon this point.*"

After this question was thus indisputably settled we hear no more of Acts of Parliament, except as promises; because, as Mr. Morson admits in the same speech, that "The expensive provisions for carrying out an efficient system of education would be entirely sacrificed." Consequently, the primary object of the members in supporting and establishing the Society is to be nullified because it does not suit him and his friends to sacrifice the Pharmaceutical school.

That great but unscrupulous statesman, Walpole, has remarked, with more pungency than truth, that every man has his price. The desire to render the Pharmaceutical School prosperous and profitable to its professor, regardless of the manifest rights and interests of the members, has been the price at which Mr. Morson sold his character for disinterestedness, and sullied the *mens conscia recti* of his matured age.

Let him prepare him his defence against the indignant charges of the members, who are fast awakening to the consciousness of their wrongs and his schemes, and try his ingenuity to evade the consequences of his craft and their folly, for he will ere long have to meet them face to face, or for ever hide his diminished head.

His colleagues deserve no small amount of censure for silently allowing such monstrous delusions to be practised on the members. They cannot pretend to be ignorant of the fact that from inherent vices in the constitution of the Society, it can never realise to the members the beneficial objects for which it was ostensibly established, and for which it continues to be supported.

Our advice to the members is to rid the Society of everything, whether it be men, journal or Pharmaceutical School, which may be inimical to or incompatible with an act of Parliament for their protection, and proceed seriously and actively to obtain a consummation so devoutly to be wished, and success will crown their laudable exertions.

CAFFEÏNE CHEMICALLY, PHARMACEUTICALLY, AND THERAPEUTICALLY CONSIDERED.*

BY M. VAN DEN CORPUT.

VARIOUS processes may be used for the extraction of caffeïne; the best consists in treating infusion of raw coffee with acetate of lead, which precipitates the whole of the *malic and cafetannic acids* and some portion of the other substances which accompany caffeïne. The acid solution is then carefully evaporated to dryness, and the residue is intimately mixed with washed sand or pounded glass; the mass is then heated in a capsule, covered with a cone, arranged in the same manner as for obtaining benzoic acid. The caffeïne volatilises and condenses on the sides of the dome.

Instead of isolating this principle by sublimation, as we have just described, the acid liquor may first be saturated with hydrated oxide of lead, filtered, the excess of lead which may be contained in the liquor eliminated by hydrosulphuric acid, filtered again, concentrated and left to crystallize. The caffeïne thus obtained is purified by repeated crystallizations.

M. M. Robiquet and Boutron recommend as the best method to precipitate the caffeïne from the decoction with an infusion of nut galls, to dissolve the deposit in alcohol, and to add magnesia or oxide of lead, which forms an abundant precipitate, and leaves the caffeïne only in solution.

It may likewise be obtained by mixing calcined magnesia with ground coffee, treating it with weak boiling alcohol and distilling the liquor to one-fourth; the caffeïne crystallizes in cooling.

M. Van den Corput mentions here the other vegetables besides coffee, in which caffeïne is found; but as it cannot at present be extracted from these vegetable with any advantage, it is useless to repeat this enumeration.

Caffeïne crystallises in long, acicular, flexible prisms, of a brilliant white, silky, inodorous, at first almost flavorless, but afterwards very bitter. The crystals of caffeïne contain two equivalents of water, which it loses at 212° F. Independently of this, analysis gives for its elementary composition, $C^8 H^5 N^2 O^2$; consequently it contains about 27 per cent. of nitrogen. It is therefore one of the most *animalised* of the vegetable principles.

Caffeïne fuses at 350° F, and *sublimes without alteration* at about 723° F. If suddenly cooled, while fusing, it instantly solidifies in an anhydrous state in a crystalline mass.

The hydrated crystals of caffeïne are soluble in 93 parts of cold water, in 158 parts of alcohol and in 298 parts of ether. With heat these vehicles dissolve more. Tannic acid forms an insoluble precipitate of tannate of caffeïne. (See CHEMIST, No. 1, page 2.)

According to M. Payen, caffeïne exists in raw coffee combined with a large proportion of *chlorogenic* or *caffetannic acid*, in the state of a double salt with potassa; the portion of this alkaloïd which is free may be removed by cold water.

According to Pfaff, the coffee berries, when raw, only contain about 1,500, but this proportion is evidently too small, for if the grains reduced to powder are exhausted by the method of displacement, about 98,100 grains per pound of caffeïne will be obtained, whereas Robiquet and Boutron found only 52 grains, and J. Stenhouse only 12·18 grains in the same quantity of original matter.

According to the analyses of Payen (see the Chemist, No. I.), 100 parts of green Martinico coffee, when dried, contain 2·46 of nitrogen, whilst the product of extraction from 100 of the same berries when roasted gave only 0·72 of nitrogen. Now if the 2½ per cent. of nitrogen existing in the raw coffee is equally divided between the two nitrogenous principles contained in this grain, namely, caffeïne and legumine, a simple calculation proves that the unroasted berries contain nearly 4 per cent. of the first and 9 per cent. of the second. As for roasted coffee, the 0·7 decigrammes of nitrogen existing in the 16 to 19 grammes of extract furnished by 100 grammes of torrified berries answer to about 2½ of caffeïne, whilst the legumine, rendered insoluble, remains almost entire in the apothem which constitute the grounds.

We see by the preceding, that if torrefaction deprives coffee of a portion of the caffeïne, still, when the operation is well conducted, it leaves a sufficient appreciable quantity fully to account for the beneficial effects produced by this cephalic liquor.

* *Journal de Chimie Médicale*, Aug. 1850.

It results from the observations of Dr. Lehmann, that, when introduced into the system, caffeïne has the effect of augmenting the secretion of *urea* and *bile*.

In a strong dose, caffeïne seems to act as an emetic, doubtless in consequence of the hypersecretion of bile which it produces.

As for the manner in which this substance behaves in the presence of reagents, it has not hitherto been much studied, and the greatest obscurity prevails in this respect in the works of the few chemists who have occupied themselves with it.

The basic affinities of caffeïne are very weak; it manifests scarcely any observable alkaline reaction, it nevertheless forms, with the acids, salts, which will in general crystallize, but the greater part of which are decomposed with great facility.

This substance is likewise capable of combining with the bases, and even with certain metallic salts, such as the chlorides of gold, of mercury, &c.

The most *stable* combinations formed by this substance are, according to our observations, those which it contracts with the acids of a negative polarity in relation to the feeble basic power of caffeïne, and which at the same time are not volatile below the temperature at which the alkaloid becomes vapor. The conditions are found in most of the fixed organic acids. If we now consider that, of all the organic acids, lactic and citric acids, or their analogues, are those which the stomach best assimilates, and which yield most easily to the modifications which the vital evolutions must cause them to undergo, we shall then understand how it is that after the above observations, and guided especially by the antiperiodic properties of citrated coffee, we should have been led to propose the use of the citrate and other salts of caffeïne.

CITRATE OF CAFFEÏNE.

This salt is obtained by adding to saturation, pure caffeïne to a solution of citric acid and exposing it to a temperature of 104° F.: the salt crystallizes in long satin-like needles of a brilliant white, grouped concentrically round central points.

It may likewise be obtained by exhausting powdered raw coffee with a very weak solution of citric acid, agitating the liquor with an equal volume of ether, decanting it and leaving it to crystallize after concentrating the aqueous solution.

This salt is readily soluble in water. The amount of tribasic citric acid saturated by the caffeïne is relatively but small; acetate of lead produces only a slight cloudiness in the solution of this citrate.

POWDER OF CITRATE OF CAFFEÏNE.

Powdered sugar . . . . . 1 oz.
Citrate of caffeïne . . . . 16 grammes.

Mix. Divide the asbestiform crystals of the citrate of caffeïne with the assistance of the sugar, and divide the mixture into doses of 15 grains.

CITRATE OF IRON AND CAFFEÏNE.

This is prepared by the combination of 1 part of caffeïne with 4 parts of citrate of iron. The product will be in radiated crystalline scales, of an orange yellow color. It is very soluble in water.

LACTATE OF CAFFEÏNE.

This compound is obtained by direct combination. By dissolving the caffeïne in dilute lactic acid, and evaporating at a regular heat, it crystallizes with difficulty, and most frequently forms an amorphous or confusedly crystalline mass.

It may likewise be obtained by treating with heat the infusion of green coffee and lactate of lime, filtering and evaporating the liquor.

LOZENGES OF LACTATE OF CAFFEÏNE.

Powdered sugar . . . . . 2 oz.
Lactate of caffeïne . . . . 32 grammes.
Caffeöne (essential oil of torrified coffee) . . . 1 drop.
Mucilage of gum tryacanth q. s.

Make a plastic mass and divide into 15 grains.

MALATE OF CAFFEÏNE.

This salt may be prepared in the same manner as in the preceding. It crystallizes in stars with acicular rays. It is very soluble.

SYRUP OF MALATE OF CAFFEÏNE.

Malate of caffeïne . . . . . 1 drachm.
Orange flower water . . . . 1 ounce.
Simple syrup . . . . . ½ pound.

Dissolve the malate of caffeïne in the orange flower water or in a sufficient quantity of distilled water, then add the syrup.

HYDROCHLORIC SOLUTION OF CAFFEÏNE.

Caffeïne . . . . . 7 grammes.
Distilled water . . . . . 3 oz.
Pure hydrochloric acid. . 2 drops.
Syrup of orange flowers . ½ oz.

F. S. A. Dose, a tablespoonfull. In intermittent fevers

COLLYRIUM OF CAFFEÏNE.

Pure caffeïne . . . . . 1 part.
Distilled water 100

To dissolve the caffeïne readily, it is necessary to use boiling distilled water. It is allowed to cool.

In fomentation as a collyrium. It may be diluted with double or treble the quantity of water.

During the publication of this work of M. Van den Corput, M. Hanon recognised

the virtues of caffeine as a specific against the headache, and recommended the following preparations, all having for their basis the citrate of caffeine.

1st. PILLS OF CITRATE OF CAFFEINE.

Citrate of caffeine . . . . 10 grammes.
Extract of dandelion . . 20 grammes.

Mix carefully.—F.S.A. into pills of 3 grms.

Administration. One pill every two hours on the day before the attack of headache, or every hour from the commencement of the attack of pain.

2nd. SYRUP OF CIRATE OF CAFFEINE.

Citrate of caffeine . . . . . 1 drachm.
Simple syrup . . . . . 4 ounces.

Dissolve and form a syrup, which is to be prescribed in the proportion of one ounce in five of the vehicle.

A dessert spoonful to be taken every two hours the day befor·, or every hour on the day of the attack.

3rd. DRAUGHT AGAINST HEADACHE.

Syrup of citrate of caffeine . . . 1 oz.
Infusion of green tea 5

Mix. To be taken as desired in the preceding preparation.

4th. LOZENGES OF CITRATE OF CAFFEINE.

Citrate of caffeine . . . . . 1 drachm.
Sugar and gum tragacanth q. s.
Mix and form thirty lozenges.

Take one lozenge every four hours on the day before the attack, and one every two hours on the day of the attack of headache.

5th. OINTMENT OF CITRATE OF CAFFEINE.

Citrate of caffeine . . . . 10 grammes.

Dissolve in a little hot water and incorporate with lard 1 oz.

This ointment will be of great service in cases where the citrate of caffeine is not tolerated either by the stomach or the rectum. It is to be applied either on the groin or armpit previously grazed, or on the inside of the thighs; the part to be then covered with gummed silk.

6th. ENEMA OF CITRATE OF CAFFEINE.

Citrate of caffeine . . . . 5 grammes.
Water . . . . . 12 oz.
F. S. A.

One half of the enema on the day before, the second on the very day of the attack.

The preparations with lactic and tartaric acids should be imitated from those with citric acid.

Editor's Note.—We must here mention that coffee had been already employed as a medicine, and that a *febrifuge draught of coffee, syrup of coffee, and vinegar of coffee* were known, and the formulæ inserted in several pharmacopœias.

ON THE LEAVES SENT FROM BOLIVIA UNDER THE NAME OF MATICO, AND WHICH ARE REPRESENTED AS VERY EFFICACIOUS FOR THE CURE OF WOUNDS.*

BY M. MERAT.

On the 14th of last March, M. Velpeau and I were directed by the Academy to verify the properties of some leaves sent by the legation at Bolivia, under the name of *matixa* or *matico*, transmitted by the Marquis de Santa Cruz to the Company. These leaves were mentioned as useful in the cure of wounds, in the dose of a drachm and a half in powder, spread on the wounds; or they may be applied whole to the surface. (Letter of M. de Santa Cruz to the Academy, dated February 16th, 1850.)

In Peru these leaves are esteemed styptics and astringents, and the natives, it is said, use them as we have mentioned, especially as a remedy in different kinds of hemorrhage.

One of us, M. Velpeau, powdered these leaves and used them on several patients, when they not only did not heal the wounds, but on the contrary have, in some cases, rendered them so painful, that the patients have refused to have them applied again.

When whole they are even less efficacious. For my part, I have had occasion to know that in the case of a wound from which there was frequent hemorrhage, this symptom, far from diminishing by their application, has rather increased, so that it has been necessary to give up the use of *matico* for this lady, to whom M. de Santa Cruz had sent some direct.

We therefore conclude, from this trial of the leaves of the *matico*, that they are rather hurtful than useful among us for the cure of wounds, a result foreseen by all who know the course followed by naturei n the cicatrisation of those which affect the cutaneous tissue.

This having been the only point on which the Academy was consulted, our report might terminate here, with this negative conclusion.

We have, however, thought it right to state all we know respecting *matico*.

This is not really a new medicament. The leaves which bear this name have been known in the materia medica for upwards of twenty years; they belong to a species of pepper growing in Peru, of which the botanic name was not accurately known until 1846. Authors have, indeed, mentioned different species, for a very simple

* *Bulletin de l'Académie de Médicine.*

reason, because they have never been properly named or described. I have described this species in the *Supplément du Dictionnaire universel de matière médicale*, (t. VII, p. 563,) published in 1846, under the name of *piper mat ca*, from its Peruvian name.*

In the year 1827, Mr. Trow, (the North American med. Oct.) mentioned the leaves of this plant as useful when pulverised, to apply to wounds in consequence of their styptic and astringent qualities; which is the same opinion now expressed by M. de Santa Cruz.

In 1832, Dr. Duthrouil, one of the correspondents of the Academy, sent us from Bordeaux, some leaves of matico, brought by a traveller from Peru, and described them, according to the natives, as a powerful astringent, which we applied to the word *matico* in the *Dictionnaire universel de matière médicale*, (t. iv. p. 254). It was even asserted that if applied on an opened vessel, these leaves would stop the hæmorrhage, *whatever might be its calibre.*

In March, 1835, Dr. Sommé, of Anvers, another correspondent of the Academy, sent us some leaves of *matico*, which a captain had brought from Peru in consequence of the great reputation which these leaves had in that country. This captain extolled them as antihemorrhagic, and mentioned besides, that they were prescribed for chronic blennorrhagia, in the dose of a drachm and a half each day. Dr. Sommé said that he had used them successfully against hemorrhage, (without explaining if it were internally or externally).

Dr. Lanes affirms having advantageously administered *matico* in discharges from the urethra, in leucorrhea and in dysentery. He says besides that *matico* has antispasmodic, and even emmenagogue virtues, which it is difficult to reconcile to the astringent properties more generally attributed to it; but he has not been able to prove the latter assertions.

The result of these facts appears to be, that if *matico* does not possess the virtue of stopping the bleeding of an open vessel, if it does not instantly heal a wound, it has astringent properties which might render the employment of it useful amongst us, if we possessed this medicament in sufficiently large quantities, and could try it in the maladies indicated by Drs. Sommé and Lanes. The Brazilians, according to Marcgrave and Pison, who speak of a period so far removed as two centuries, use several species of pepper in gonorrhea, so that the use made amongst us of the pepper cubeb, and even of common pepper, in this malady, should be considered only as an imitation of the natives of Brazil. It is known that the use of the first in gonorrhea is practised by the Indians, who taught it to the Europeans, as was likewise the use of the bark of the pomegranate root against the tape-worm.

The leaves of the *matico*, pressed between the fingers, are aromatic, when chewed, their flavor, at first not being powerful, is afterwards slightly bitter and even acrid. Their infusion in cold water is limpid and yellowish.

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* These leaves had been at first referred to the *piper reticulatum* L., the *jaborandi* of Pison, according to the Swedish botanist, which is not correct; besides which the name of *jaborandi* is common to several species of Brazilian peppers. That figured in Pison's and in Marcgrave's work is a plant from the Antilles quite different from that of Peru. Other authors, deceived by the appearance of the leaves, have thought that the *matico* was the *piper asperifolium* of Ruiz and Pavon. But the leaves of this species are covered with transparent spots like those of the orange tree, which are not found on the *matico* nor on those of the *piper aduncum* Miguel, nor the *piper verbascifolium* of the same, which are of the same character, and which are mentioned as furnishing *matico*. Besides some have wished to include the *piper hispidum* Humb., a vegetable but little known, with hairy stalks, which do not exist in the *matico*. This pepper approaches more nearly to the *piper* (Artanthe) *angustifolium*, Lam.; but it has not like this plant hairs laid back on the stalks, petiole and middle vein of the leaves.

The characters of the *piper matica* Merat, as far as we can judge by the fragments of this vegetable sent by the legation of Bolivia and in trade, are as follows: it is a shrub with the stalks articulated, with round swellings at the articulations, pubescent and greyish; short petioles; with lanceolate oval or narrow lanceolated leaves without spots, rough, tuberculous above, rounded and rather heart-shaped at the base, from 2 to 4 or 5 inches long, rather pointed at the summit with smooth edges. The flowers are in spikes. It grows in Peru.

For the different species of peppers mentioned in this article, see the monography of the genus *piper* of M. Miquel, entitled, *Systema piperacearum*, Rotterdam, 1844, in 8vo. The name of *matico* is not applied to any of the species mentioned in this work.

HISTORY OF PHARMACY AMONG THE GREEKS AND ROMANS.

BY M. CAP.

(Concluded from page 474.)

CLAUDIUS GALEN was born at Pergamus, in Asia Minor, in the year 131 of the Christian era, and died in the year 201, at the age of 70. He lived, consequently, under the emperors Adrian, Antoninus, Marcus Aurelius, Lucius Verus, Commodius, Pertinax and Septimus Severus. His father was an architect and senator. Adrian induced him to cause his son to study medicine. He was wealthy and learned, and devoted himself seriously to the education of the young Galen, who, after the death of his father, and at the age of twenty-one, went to Smyrna, to study philosophy; he afterwards went to Corinth, Lycia, and Palestine, to observe jet and asphaltum. Alexandria was at that time the centre of the learned world. Galen passed some years there to perfect himself in the study of anatomy, that branch of the art which he made the subject of his favorite researches.

At the age of 28, he returned to his own country, where the priests of Æsculapius entrusted to him the treatment of the athletæ. Some years afterwards, a revolution having broken out at Pergamus, he quitted that city, and went to Rome; he was then thirty-four years of age. He there dislocated his arm, which, however, did not prevent him from rapidly acquiring very great celebrity. He associated with men of science, philosophers, and great personages, and among others, with Severus, who afterwards became emperor.

In the following year, during an epidemic, which prevailed in Rome, he went to Brindusium, and embarked for Greece. He visited Cyprus, and brought from it the diphrix or diphriges (oxide of copper,) then much employed as an astringent and a detersive. His travels, the object of which always was the increase of his knowledge, furnished him with opportunities of making researches in natural history. Thus, in Cyprus, he studied metallurgy; in Palestine he observed the opobalsamum; at Lemnos, terra sigilla. He was 38 years old, when Marcus Aurelius and Lucius Verus, who were in Illyria, engaged in warfare with the Marcomans and Germans, called him before them. He travelled on foot, through Thrace and Macedonia, and repaired to Aquila, when he prepared the theriacum of Andromache, for the use of the two emperors. The plague having broken out, and carried off Lucius Verus, Galen returned to Rome, when he was appointed physician to the young emperor Commodius. He was more than fifty years of age when he returned to his own country, where he died, according to Suidas, at an advanced age.

Without entering here into the basis of the medical doctrines of Galen, we cannot give an idea of his system relative to the action of medicines, without touching on certain generalities with regard to these doctrines; we will do so, however, with all the reserve which our principal object requires. The following is this system in few words.

The first elements of all bodies, according to the theory of Empidocles, adopted by Hippocrates, are fire, water, air and earth. The qualities of these elements are hot, cold, dry and humid. These same qualities exist in medicaments, and every part of our organism exerts on them an action which partakes of the similarity which exists between the organ and the medicament

So long as none of these elements predominates in the organism, and so long as the parts of which it is composed have a proper *temperature*, (temperament) the latter act in a regular manner. But as soon as one of them is in excess, the equilibrium is disturbed, derangement results, and the functions are altered. It is even sufficient for these organs to vary in their size, figure, number or situation to cause a departure from their ordinary state: it is this which constitutes good or bad health.

Medicine has two objects: the preservation of health and the cure of diseases. The duty of the physician is to maintain the *temperature*, and to correct the derangement of the organs, and that by means which are in relation with these two states.

The species or cause of the disease always indicates the remedy; but there are causes which are in the very nature of the organisation, and others which result from accidents. That which nature has not done, it is clear the physician cannot do; but he can aid it in its efforts for re-establishing the equilibrium necessary to the state of health.

The elementary qualities which exist in an individual form what is called his *temperament*. These qualities may be combined among themselves, which multiplies the kinds of temperaments.

Every active medical substance may, like the elements of nature, be hot or cold, dry or humid. These are then its primary qualities, at the knowledge of which we arrive by that of the secondary qualities

which are no other than its physical properties. The physical properties of medicines determine, consequently, their mode of acting.

The primary qualities have several degrees. Chicory, for example, is cold in the first degree, pepper is hot in the fourth. Flavor, and other apparent properties, as bitter, acrid, and saline, relate to the primary qualities. The saline, for example, is hot, the bitter is dry, sour is cold, &c. These qualities may appertain to them *actually* or in *power*. Ice is actually cold, mandragora and hemlock are cold only in power; fire is hot actually, pepper is so only in power.

Galen divided medicaments, relatively to their action, into specifics, poisons and counter-poisons. Purgatives, according to him, act by their whole substance, and possess the property of attracting each a particular humor, in relation with its own nature.

We proceed no further in this exposition. Can it be believed that such a system was the most striking result of the meditations of antiquity relative to the action of medicines? Can it be conceived that this doctrine was maintained for thirteen centuries, that it reigned in Europe, Africa and Asia, and that it still flourishes in certain nations, certainly not much advanced, as the Turks and Arabs? Such however, is the fact, and one of the most striking examples of the authority which may be exerted, even in the sciences, by the talent of exposition, the prestige of the personal dictum and merit of a superior man. To explain such success, the cause must be sought in the extraordinary circumstances which surrounded the appearance of the physician of Pergamus.

Medicine was then divided into a multitude of sects and schools, in which reigned, besides emulation, vain subtilties and fruitless discussions. Galen was unwilling to belong to any of these schools, and sought to bring back the science in the way of Hippocrates, that is to say, into the way of truth. He collected the opinions and doctrines of all the celebrated men who had gone before him, and, from these materials he raised an ingenious system, easily understood, which he developed by means of information full of charms and seductiveness He put an end to the uncertainties of his age, and applied himself to introducing into medicine the scientific forms derived from the peripatetic school. Elevated talents, indisputable genius, the number of his writings, the order and logic by which they are characterised, the purity and elegance of his style, all, even to his eloquence and his assurance, contributed to carry the mind along with him and to render him deserving of a glory which, for brilliancy and duration in the history of sciences, can only be compared with that of Aristotle.

Galen had made excellent philosophical studies. In his youth, he wrote commentaries on the dialectics of Chrysippus. He expressed himself with extreme facility, his knowledge was universal. The number of his writings amounted to not less than five hundred. We do not now possess more than a third of them. Among these writings, there are several on the medicinal substances and a greater number on the composition of medicines. The fourth and fifth parts of his works* contain eleven books which treat of simple medicaments, one of succedanea or *qui pro quo*, two of theriacum and mithridate, seven of the composition of medicaments, according to their kinds, and ten of the composition of medicaments, according to their *places of application*.

Not content with having collected all that his predecessors had written on this subject, Galen collected from all parts recipes for pharmaceutical preparations, and he often bought them at a very high price. Although he approved of the simplicity and reserve of Hippocrates relative to the employment of medicines, he did not cease to employ them himself in greater number, and, particularly, with greater complication. The materia medica is, indeed, one of the points on which he departs most from the ideas of the physician of Cos, still, the most monstrous of these heaps of drugs must not be attributed to him. It may even be remarked that his own formulæ are less overcharged than those which he derived from other authors. He condemns, on more than one occasion, the abuses which are detailed by them, he blames the physicians who recommended cosmetics, and especially those who give instructions in preparing poisons; but the care which he took in writing at such length on pharmacology, shows what importance he attaches to this matter. It may be added that his example had great influence on the complication of medicaments, a complication still preserved by the Arabs, and which was propagated almost to our own time. It is, indeed, because he was the physician who wrote most on medicaments, that this part of the art for a long time bore the name of Galenic pharmacy.

* Edition of Basle, 1538, 5 vol. in fol.; or that of Venice, 1625, 8 vol. in fol.

The distinction between Galenic pharmacy and chemical pharmacy was established at the time of Paracelsus and Van Helmont, to separate the physicians who remained attached to the doctrine of Galen from those who joined the new sect. It is known that Paracelsus labored to substitute for the system of elementary qualities that of the chemical elements of his school, a system which was still connected with the cabalistic absurdities, and which so long retarded the progress of rational chemistry. In most of the Pharmacopœias of the 17th and even of the 18th century, medicaments were divided into two great series: the first composes all medicaments whose basis is of organic nature, prepared by simple mixing, and in which it was not suspected that there should be any chemical decompositions; the second contained all those in which the acids, the alkalis, the salts, the metals, &c., take part, and in which chemical phenomena performed an important part.

The authority of Galen, with respect to medicaments, subsisted longer than the authority of his medical doctrines. The latter began to be impaired in the 16th century, and, at the commencement of the 17th, the discovery of Harvey struck the last blow at it.

He had this in common with Aristotle, that after having been for thirteen centuries the oracle of science, even the most indisputable points of his merit and title to glory were denied. But if the respect and enthusiasm which he inspired were long exaggerated, the contempt and ingratitude of the moderns in his regard were no less extravagant. Galen was the last, and one of the most eminent physicians who adorned antiquity. No other was endowed with so brilliant a genius, possessed such vast erudition, or such varied talents. It is to him that we owe the preservation of the precious remains of ancient philosophy and of the true principles of the school of Cos. His authority in medicine equalled that of Aristotle in philosophy; his writings are the most prolific, and the best arranged which the science of antiquity has bequeathed to us. Should we attribute to him the superstitious worship of which he was the object at a period when medicine derived nothing from its own sources, and subsisted only on what had been bequeathed to it by one of the most brilliant periods of civilisation? The finest mind, the purest taste, adorned that genius so powerful in his capacity, the most extended, perhaps, of his time. His elocution was rich and facile; his style is so elegant and so pure, that he has remained a classical authority. Perhaps he sometimes abused these rare qualities, and deceived himself as to the influence which might be accorded to them. The desire of shining, of rendering truth more striking, of explaining even that which is inexplicable, often carried him beyond certain limits; but ought we not excuse something in superior minds, and whatever be the elevation of their minds, do they not owe some weakness to the conditions of human nature?

Galen was superstitious: he believed in dreams and divination. He had a great reverence for Esculapius, whom he called the god of his country, and believed that it was he who inspired him in the employment of certain curative means. He says that the sedative property of lettuce juice was revealed to him by the dream of one of his patients. His vanity was excessive. He said that Hippocrates had indeed opened the road of medical observation, but that he had smoothed all its difficulties, as Trajan had rendered practicable the roads of the Roman Empire.

Like most of the physicians of his period, Galen practised at the same time the various branches of the healing art. He especially exercised Pharmacy, and kept, as he himself says, a shop at Rome, in the Sacred Way. This shop was destroyed by fire, in the reign of Commodus. Another fire, which consumed the Temple of Peace, burned a portion of his books.

Is it then a trifling glory, a vain title to illustriousness, for a scientific profession, to be able to mention among those who have exercised it, such men as Hippocrates, Aristotle, Theophastus and Galen, to reckon among those who have practised or celebrated it, heroes, monarchs, and poets? This was the case with Pharmacy in ancient times. In pursuing the history of modern times, we shall not fail to discover for this art new titles to the estimation of men of science and the gratitude of humanity.

MODES OF ADMINISTERING COD LIVER OIL.

The use of cod liver oil has now become so universal that it will be useful to make generally known the formulæ by means of which its administration may be rendered less disagreeable. It is well known that even the purest qualities of this oil always have a very disagreeable taste.

* *Journal de Chimie Médicale*, June, 1850.

The following are the formulæ:—

First formula.

R. Cod liver oil	30	grammes.
Solution of carbonate of potassa	8	,,
Syrup of orange.....	30	,,
Essence of cloves.....	4	drops.

A teaspoonful twice a day.

Second formula.

R. Cod liver oil.....	30	grammes.
Syrup of orange.....	30	,,
Distilled aniseed water	30	,,
Essence of cloves	3	drops.

A tablespoonful twice a day.

Third formula.

R. Cod liver oil	250	grammes.
Gum in powder.....	30	,,

Make into an emulsion, then add

Syrup of orange.....	30	,,
Syrup of peppermint..	60	,,

A tablespoonful twice a day.

Cod liver oil may likewise be given as an opiate, according to the following formulæ:

R. Cod liver oil ..... 4 grammes.
Magnesia q.s. for saturation.

But as it requires nearly double as much magnesia by weight as of oil for saturation, this mode of administration has the great inconvenience of obliging the invalid to take too large a bulk of medicine.

The disagreeable taste of cod liver oil may be disguised likewise, by taking it in hot milk, or in very hot coffee; but we must confess that the best mode of administering this medicament is to give it without any mixture. We often succeed in making it tolerated, by prevailing on the patient to gargle the mouth with a spoonful of brandy, both before and after taking the oil. The papillæ of the mouth, rendered less sensitive by this means, will thus permit doses powerful enough for every good purpose. Finally, if the patient is much tormented by nauseau, or inclination to vomit; when the swallowing of the oil is followed, as we have sometimes seen, by so great a disgust as to occasion abstinence from all food, the cod liver oil may be given at bed time, and just before going to sleep; the digestion of the oil takes place during the night, facilitated by the horizontal position and the perfect stillness. We have ourselves thus succeeded in rendering cod liver oil supportable to persons who could not become accustomed to it by other means.

ON THE PREPARATION OF SYRUPS OF VALERIAN AND GENTIAN.

BY M. MALFILATRE.

For the purpose of simplifying the process described by the *Codex* for the preparation of syrup of valerian, M. Malfilatre proposes to operate in the following manner.—

R. Wild valerian root, peeled and bruised..	50	grammes.
White sugar.....	2,677	,,
Cold water.....	q.s.	

The root is put into a displacement apparatus, and is lixiviated with water, using the precautions employed in such circumstances, until a liquid is obtained of the density of 1350, in which the prescribed quantity of sugar is dissolved by a gentle heat in a close vessel.

Syrup of gentian is prepared in the same manner, always retaining, as in the former case, the proportions directed by the *Codex*.

According to M. Malfilatre, products obtained in this way, would be better than those prepared according to the directions of the *Codex*.

* *Journal de Chimie Medicale*, June, 1850.

FEBRIFUGE AND ANTIPERIODIC PROPERTIES OF CHLOROFORM.*

BY DR. DELIOUX.

Dr. Delioux, professor at the Normal School of Rochefort, addressed to the Academy a note in which he communicates the beneficial results which he obtained in intermittent fevers from chloroform administered internally. He gives it in a draught or mixture in the dose of 75 centigr. (11·576 grains) to 2·50 grammes (38·585). By following the same mode of administration as for other febrifuges, the draught is taken in three times, with an interval of a quarter or half an hour, in such a manner that the last dose be administered three or four hours before the anticipated return of the access. Dr. Delioux has not remarked that there was any diminution in the volume of the spleen: however, the fits were completely quelled in certain cases, and in others the treatment completely failed. Dr. D. does not propose chloroform as a substitute for quinine, to which he has found it very inferior; but he presents it as capable of rendering some service in cases in which the antiperiodic *par excellence* has failed. The chloroform draughts have a strong etherial and minty taste, which is not repulsive to the patients; some of them have experienced a transient sensation of heat in the pharynx extending to the stomach; but, except this sensation, nothing troublesome or painful. Sometimes a very slight and temporary intoxication is manifested, but it is rarely followed by intense cephalalgia.

* *Archives Generales de Medicine.*

ON QUINOIDINE.*

BY R. LEHMANN AND E. VOLLAND.

R. LEHMANN, a pharmaceutist of Prenzlau, has examined quinoidine, two drachms of which being treated with alcohol, left a residue of one-third. Of this undissolved portion, water took up two-thirds, consisting of sulphate of soda and sulphate of potassa. In the last undissolved residue, a considerable quantity of copper was discovered. Sulphuric acid dissolved the remainder, with the exception of five grains of earthy matter. The alcoholic extract contained no copper.

A second specimen of quinoidine left, on being exhausted by alcohol, a calcareous residue, which formed a sixth part of the whole quinoidine. This residue was insoluble both in hot alcohol and in water, but was dissolved by diluted sulphuric acid. The filtered solution on evaporation yielded crystals, and a dark precipitate, which precipitate always reappeared when the solution ceased to have an acid reaction. The crystals appeared to be sulphate of cinchonia, from which, however, quinine was obtained by means of ether. From two other sorts of quinoidine, the author obtained inconsiderable residues of sulphate of potassa and soda, phosphate of soda, ammoniacal salts, and lime. One specimen also yielded a trace of copper. The variations in the qualities of commercial quinoidine gave rise to much inconvenience, as medicines prepared with them are not uniform in their appearance. Thus the author often received prescriptions ordering Tinct. chinoidini c. aq. menth. pip. et acid. sulph. dil., the latter in a small quantity; and also Tinct. et aq. menth. in such proportion, that precipitation must take place. This happened with every tincture prepared with fresh quiniodine. Sometimes the precipitate settled at the bottom, sometimes it remained for a length of time at the surface, and adhered gradually everywhere; at one time the mixture was dark brown, another light brown, and sometimes brownish-white, almost milky.

E. Volland examined a sort of quinoidine which was adulterated with a large quantity of pine resin. One hundred parts contained:—

Quinoidine	43·334
Resin	43·383
Matter insoluble in spirit of wine	8.333
	100·000

The author found by direct experiments, that equal parts of quinoidine and pine resin very easily combine. The commercial quinoidine in which this adulteration was discovered, consisted of a four-sided prism, half a foot long, and weighing one pound. It was not so dark as that usually met with, and had a green tinge. It was very brittle, and a small piece kept in the warm hand, became soft, but with difficulty, whilst genuine quinoidine becomes so soft in the hand that it can be moulded. In spirit of wine it dissolved, leaving but a small residue; in diluted sulphuric acid the residue was considerable, and melted in a porcelain capsule, forming a dark brown resinous mass, which, on being heated in a platinum spoon, evolved an odor at first slightly of burning quinoidine, but afterwards like strongly heated resin or pitch, and on igniting the vapors it was consumed with a strongly sooty flame. After incineration, scarcely any residue was left. This quinoidine is said to have been imported from Bavaria.

Two other sorts of quinoidine, one from England, the other from Basle, were examined by Volland. The first was darker than the usual quinoidine: small quantities of it held for some time in the warm hand, became soft and shapeable, even more so than is the case with good dry quinoidine. In alcohol and diluted sulphuric acid, it was dissolved with only a slight residue. The filtered solution of half a drachm of this quinoidine in diluted sulphuric acid, gave by precipitation with carbonate of soda by heat, twenty-eight grains dry quinoidine=93·33 per cent. Ether dissolved 73 33 per cent. The residue not dissolved by the ether, was treated with water, and then with spirit of wine, by which 17·5 per cent. more were dissolved, and a residue of about four per cent. insoluble in these solvents remained behind.

The other sort, from Basle, had the consistency of a thick extract, a blackish-brown color, and appeared to be the inspissated mother-liquor obtained in the preparation of the sulphate of quinine.

* *Pharm. Cent. Blatt.* 1850, No. 12; and *Pharmaceutical Journal.*

CHLOROFORM IN THE TREATMENT OF CUTANEOUS DISEASES, AND IN SOME NERVOUS AFFECTIONS.*

BY DR. DEVERGIE.

DR. DEVERGIE has employed chloroform in hysteria, sometimes as a draught (12 drops of chloroform in a draught of 60 grammes = 926 grains,) sometimes by inhalation.

* *Bulletin de Therapeutique.*

He mentions among others a case in which 12 drops of chloroform poured on a hand-kerchief, placed under the nose of a patient, not only caused the termination of a violent fit of hysteria, but also cured the patient who had previously had 4 or 5 fits per month, and which had never before yielded to any treatment.

Dr. Devergie, likewise tried chloroform in cutaneous diseases with great success: however, his conclusions are that this medicine, in diseases of the skin, is exactly similar to camphor; it is a sedative in itchings, and it has the advantage over camphor of acting on the nervous system in general by the atmosphere with which it surrounds the patient; it is even more sedative than camphor, but it has a less marked resolutive action on the skin. However it has scarcely appeared to be useful, except in papulous affections in which it is employed in the form of pommade in the proportion of 2 or 3 grammes to 30 grammes of lard.

PRESUMED POISONOUS EFFECTS OF GUANO.*

BY J. WEARNE, ESQ., HELSTON, CORNWALL.

PHILIP W——, aged sixty, a robust and industrious husbandman, required Mr. Wearne's attendance on the 1st June; he found that from some cause he was suddenly attacked by a general tumefaction of the eyelids and lips, and with all the symptoms of the most acute quinsy, together with a total inability to articulate.

The general aspect of the man seemed to indicate that some animal poison had gained admission into the circulation. The tumefaction, under nitric acid and myrrh gargle, leeches and enemata, gave way by the third day sufficiently to enable the patient to tell, that two days previous to his attack he had been sowing guano in drills in his field, and that the wind blowing hard at the time, and the guano being light and dry, he had great difficulty in accomplishing his work, the guano so affecting his breathing as nearly to suffocate him.

On the fourth day symptoms of pneumonia set in, accompanied with extreme debility, and, in spite of the treatment usual in such cases, the patient quickly succumbed.

* *The Lancet*, June 29, 1850.

ON THE OXIDE OF SILVER AS AN AGENT FOR THE EXPULSION OF TAPE-WORM.*

BY H. T. WHITTELL, ESQ.

THE high price of Kousso as a vermifuge, and his success in two cases, have led Mr. Whittell to suggest the use of oxide of silver. He had occasion to prescribe as a remedy for menorrhagia, one grain of the oxide of silver three times daily, with an ounce of mixture containing six drachms of bitartrate of potassa in the half pint. The fourth dose was followed by the evacuation of a large quantity of tape worm, with which the lady had long been troubled; and she was better than she had been for months.

In the second case, the medicine was prescribed expressly to destroy the worm, and with similarly beneficial results.

COMPOUND PILLS OF VALERIANATE OF ZINC.†

BY M. E. SEGUIN.

First formula.

Valerianate of zinc.....	1 gram.
Extract of quinquina.....	1 „
Extract of gentian	1 „
Extract of belladonna.....	10 centigr.

F. S. A. and mix to form 10 pills, which will then be silvered. One pill morning and evening, in the case of continued neuralgia.

Second formula.

Valerianate of zinc.....	50 centigr.
Valerianate of quinine....	50 „
Extract of quinquina.....	1 gram.
Extract of gentian.....	1 „
Extract of belladonna....	10 centigr.

F. S. A. and mix to form 10 pills, which will then be silvered. One pill morning and evening in the case of continued neuralgia with irregular *fits*. In intermittent neuralgia, the two pills are given some hours apart, and the second administered five or six hours before the next attack is expected.

Observations.—The first formula is only suited to continued neuralgia without exacerbation.

The second formula is useful in continued neuralgia with irregular attacks; experience has shown me that it succeeds perfectly likewise with regularly intermittent neuralgia, following the same rule as in the administration of sulphate of quinine.

* *The Lancet*, June 29th, 1850.

† *Repertoire de Pharmacie*, July 1850.

I give two or three coffee cupsfull of a sweetened infusion of valerian in the course of the day, sometimes even I order an enema of a strong infusion of the same root, footbaths with mustard in them night and morning, moderate vesication on the course of the nervous filaments and trunks, finally, the general health must not be neglected.

ON VAPORS OF ACETIC ACID AS A REMEDY AGAINST CORYZA.*

BY DR. SAINT MARTIN, OF MORT.

CORYZA is certainly an affection of benign nature. It is probably to this circumstance that must be attributed the little anxiety hitherto shown to find a really efficacious treatment. It is nevertheless very certain that its development may occasion serious complications among the lacrymal, or air passages. It is not uncommon, for example, to see inflammation of the pituitary gland reach the posterior orifice of the nasal fossa, and extend progressively to the larynx, the trachea, and bronchial ramifications. Besides, coryza exhibits in some cases, a great tendency to reappear. It would, therefore, be useful to find a means for the prevention of this phlegmasia. M. Saint Martin proposes the use of the vapors of acetic acid. A phial containing a small portion of this acid is held to the nostrils, and long and slow respirations are made for about five minutes. The acetic vapors penetrate into all the recesses of the olfactory cavity, and cause a slight modification on the mucous membrane, but still sufficient to dry up at its source the flow, or nasal flux; that this means should succeed, it is only necessary that it should be used as nearly as possible at the first appearance of the coryza.

* *Repertoire de Pharmacie*, July 1850.

THE PHARMACEUTICAL JOURNAL.

IT is rumored that the Pharmaceutical Journal will in future appear without Mr. Bell's name: we warn our readers not to be satisfied with this disgraceful compromise. So much having been conceded, all that is desired may be obtained by perseverance. The monopoly should be put down.

IV. REVIEWS, NOTICES OF BOOKS, &c.

THE COMMERCIAL HAND-BOOK OF CHEMICAL ANALYSIS; OR PRACTICAL INSTRUCTIONS FOR THE DETERMINATION OF THE INTRINSIC OR COMMERCIAL VALUE OF SUBSTANCES USED IN MANUFACTURES, IN TRADES AND IN THE ARTS. By A. NORMANDY. London: G. Knight and Sons.

THIS work, and Mr. Walker's Electric Telegraph Manipulation, will be noticed in our next. We have not had leisure to read them this month.

TO CORRESPONDENTS.

If "CHEMICUS" will send his address, a reply will be given to his note in a few days. Owing to its not having been directed to Messrs. W. and T. Piper's, some delay took place in its reaching us.

"MEDICUS" is referred to the article by M. Van den Corput in this number.

We acknowledge communications from "M. P. S., (Liverpool):" "M. P. S. G. B., (2 letters):" "A CHEMIST:" "AN ASSOCIATE:" "A PHARMACEUTICAL CHEMIST:" to these, and others who write on the subject of the Pharmaceutical Society, we reply that they have success in their own hands, and if they persevere, victory is quite certain.

"TYRO." Brande's Manual, or Turner's Chemistry, will answer the purpose.

"Z." Use sulphuric acid diluted with six times its bulk of water.

"N. B." Trisnitrate of bismuth.

"X." Subacetate of lead.

NOTICE.—*All Communications, Books for Review and Substance for Notice must be addressed* "To the Editors of THE CHEMIST, care of Messrs. W. & T. Piper, Paternoster Row, London." *Communications for insertion must be prepaid, and sent before the 15th of each month. Letters requiring a reply in the following No. will in future be received as late as the 24th.*

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